

Chapter 4

Environmental Consequences

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4.1 Introduction

Chapter 4 examines the potential environmental consequences of the alternatives.

The analysis of Alternative A describes future conditions if the National Park Service (NPS) does not implement benefits-sharing. In this way, the potential for Alternatives B or C (whose potential impacts are described here) to improve or degrade these conditions can be examined. Accordingly, this DEIS informs NPS decisionmakers and the public about the effects of adopting each of the alternatives as compared to Alternative A (No Benefits-Sharing/No Action).

Council on Environmental Quality (CEQ) regulations for the National Environmental Policy Act (NEPA) require that agencies determine the environmental issues related to a proposed action that are “deserving of study” (40 CFR §1500.4, §1501.7), and discuss them in proportion to their significance (40 CFR §1502.2 (b)). This determination, and consequent level of discussion for each impact topic, is reflected in the Affected Environment chapter and is a necessary prelude to analysis.

Given its programmatic/planning nature, this DEIS describes the conditions under which certain activities may be conducted and provides potential general standards for management. As a result, the impact topics analyzed here do not represent traditional NEPA topics, such as wildlife or air quality (*see* Chapter 1, Section 1.1.1).

The NPS has proposed to implement benefits-sharing (Alternative B) as a way to improve two existing conditions: (1) the lack of legal clarity with respect to commercial use of NPS specimen-related research results (*see* Chapter 1, Section 1.3.1) and (2) the opportunity to further the current NPS goal of improving the availability of science for park management (“science for parks”; *see* Chapter 1, Section 1.3.2 and Chapter 3, Section 3.2.1).

The NPS benefits-sharing proposal (Alternative B) dedicates all benefits to resource conservation, the fundamental purpose of the national park system.¹ The NPS anticipates that benefits-sharing would be conducted through the use of Cooperative Research and

What is a CRADA?

A CRADA is defined by the Federal Technology Transfer Act of 1986 (FTTA) (15 USC 3710a et seq.) as “any agreement between one or more Federal laboratories and one or more non-Federal parties under which the Government, through its laboratories, provides personnel, services, facilities, equipment or other resources with or without reimbursement (but not funds to non-Federal parties) and the non-Federal parties provide funds, personnel, services, facilities, equipment, or other resources toward the conduct of specified research or development efforts which are consistent with the mission of the laboratory. . . .” (15 USC 3710a(d)).

CRADAs offer a framework specifically authorized by statute under which private companies and other research collaborators can provide financial resources and expertise to a federal laboratory facility to augment its own research in exchange for rights in any resulting useful or valuable discovery arising from the research (15 USC 3710a).

Development Agreements (CRADAs), with any benefits generated under such CRADAs to be dedicated to the conservation of resources protected and managed by the NPS. CRADA benefits must be used for scientific purposes.² Therefore, this DEIS focuses on the research aspect of resource conservation and management.

4.2 Methodologies for Evaluating Impacts

This DEIS uses the approach outlined in the National Park Service (NPS) Handbook, *Conservation Planning, Environmental Impact Analysis, and Decision Making* to identify the intensity (or magnitude) and duration of impacts.

Mitigating measures described in Chapters 2 and 4 would be taken during implementation of the alternatives. All impacts have been assessed assuming that mitigating measures already have been implemented. Methodologies used to evaluate potential impacts for each impact topic are described below.

This analysis includes a description of whether impacts are beneficial or adverse, and short-term or long-term. The magnitude of the impact also is described in terms ranging from negligible to major. Impacts disclosed may be direct or indirect. The definition of the magnitude, or intensity, of the impact varies among impact topics, so individual definitions are provided for each. The following definitions apply in general to the impacts analysis.

Table 4.2. Types and duration of impacts

Impact category	Definition
Beneficial impact	A positive change in the condition or nature of the resource, usually with respect to a standard or objective. A change that moves a resource toward its desired condition or prevents a foreseeable decline in a resource already existing in its desired condition.
Adverse impact	A negative change in the condition or nature of the resource, usually with respect to a standard or objective. A change that moves a resource away from its desired condition.
Direct impact	An impact that is caused by an action and occurs at the same time and place.
Indirect impact	An impact that is caused by an action but is later in time or farther removed in distance, but is still reasonably foreseeable.
Qualitative impact	An impact that can only be measured by subjective comparison to objectives.
Quantitative impact	An impact that can be measured objectively, usually in numerical terms.
Short-term impact	An impact that in a short time after an action is taken will no longer be detectable. This DEIS considers any change that is evident for 5 years or less to be short-term.
Long-term impact	A change in a resource or its condition that remains evident for more than 20 years.

4.2.1 Natural Resource Management

Potential impacts to natural resource management are assessed by determining the extent to which each alternative changes conservation and protection of resources managed by the NPS by weakening or strengthening understanding of biodiversity and ecological processes (*see* Objective 2, Chapter 1, Section 1.4.2). Because the availability of scientific knowledge can impact natural resource management programs, the potential for each alternative to provide scientific knowledge to the NPS is the mechanism for assessing impacts to natural resource management (*see* Chapter 3, Section 3.2).

Qualitative analyses are based on foreseeing whether any changes in the availability of scientific knowledge pertinent to natural resource management goals (“science for parks”) would become available under Alternatives B or C. Alternative A (No Benefits-Sharing/No-Action) serves as a baseline against which to compare the effects of Alternatives B or C.

Qualitative aspects of “science for parks” can be provided by any of the non-monetary benefits described in Section 4.4.1.1.

Quantitative analysis of Alternative B (Implement Benefits-Sharing) compares potential monetary payments to park natural resource management funding levels as well as to servicewide funding attributed to the Natural Resource Challenge in fiscal year (FY) 2004. These comparisons are indicative of the level of intensity of potential impacts (*see* Chapter 3, Section 3.2.2).

Quantitative analysis of Alternative C (Prohibit Research Specimen Collection for Any Commercially Related Research Purposes) examines the proportion of independent researchers who could be expected to be excluded from park research or who could choose not to perform park research because of the prohibition on doing research intended to produce commercially applicable results.

4.2.1.1 *Impact intensity thresholds*

Qualitative impact thresholds

Qualitative impacts are analyzed in terms of the potential for Alternatives B or C to improve or degrade the availability of scientific knowledge to parks for natural resource management purposes.

No impact: The action results in no change in new scientific knowledge.

Negligible: The action results in a slight change in the availability of new scientific knowledge about park resources.

Minor: The action results in a change in the availability of new scientific knowledge about park resources that is directly related to a natural resource management priority.

Moderate: The action results in a change in the availability of new scientific knowledge about park resources that is directly related to several natural resource management priorities.

Major: The action results in a change in the availability of new scientific knowledge about park resources that is directly related to several natural resource management priorities and substantially affects the management of those resources.

Quantitative impact thresholds

Quantitative analysis of Alternative B (Implement Benefits-Sharing) compares potential monetary payments to individual park natural resource management funding levels as well as to servicewide FY 2004 Natural Resource Challenge funding (*see* Chapter 3, Section 3.2.2).

Quantitative analysis of Alternative C (Prohibit Research Specimen Collection for Any Commercially Related Research Purposes) examines the proportion of independent researchers who could be expected to be excluded from park research.

Table 4.2.1. Intensity of quantitative impacts to natural resource management

Impact intensity	Equivalent to X% of individual park natural resource management funding levels	Equivalent to X% of servicewide FY2004 Natural Resource Challenge funding
No impact	No payments	No payments
Negligible	Less than 10%	Less than 5%
Minor	10%	5%
Moderate	20%	10%
Major	35%	15%

No impact: The action results in no monetary payments to a park or to the National Park Service.

Negligible: The action results in monetary payments equivalent to less than 10% of a park's natural resource management funding level; or servicewide, to less than 5% of servicewide FY2004 Natural Resource Challenge funding.

Minor: The action results in monetary payments equivalent to 10–19% of a park's identified natural resource management funding level; or servicewide, to 5–9% of servicewide FY2004 Natural Resource Challenge funding.

Moderate: The action results in monetary payments equivalent to 20–34% of a park's identified natural resource management funding level; or servicewide, to 10–14% of servicewide FY2004 Natural Resource Challenge funding.

Major: The action results in monetary payments equivalent to more than 35% of a park's identified natural resource management funding level; or servicewide, to more than 15% of servicewide FY2004 Natural Resource Challenge funding.

4.2.1.2 Contexts

Potential impacts to natural resource management programs are analyzed in three contexts as listed below:

- 1) Servicewide effects;
- 2) Effects to Yellowstone National Park; and
- 3) Effects to other individual parks (Chapter 3, Section 3.5.3, describes the park units most likely to be affected by Alternative B).

Yellowstone National Park was selected for a park-specific analysis because the historical patent record suggests that multiple discoveries with commercial application were based on research involving research material originating in Yellowstone (*see* Chapter 1, Section 1.2.4), which suggests that under Alternative B, the majority of NPS benefits-sharing agreements would occur between researchers and Yellowstone.

4.2.2 Visitor Experience and Enjoyment

Potential impacts to visitor experience and enjoyment are assessed by determining the extent to which each alternative would change conservation and protection of resources managed by the NPS by weakening or strengthening understanding of biodiversity and ecological processes (*see* Objective 2, Chapter 1, Section 1.4.2).

The availability of “science for parks” can affect the quality of interpretation as well as the quality of natural resource management, both of which affect visitor experience and enjoyment of parks (*see* Chapter 3, Section 3.3). The impact analysis in this section focuses qualitatively on the impacts to visitor experience and enjoyment from changes in the availability of scientific knowledge and assistance to interpreters.

Under Alternative B, specific interpretive services designed to enhance visitors’ understanding and acceptance of natural resource management goals would benefit from interpretively focused scientific education and training assistance or research. Research for interpretation could include, for example, site-specific research conducted to determine the effectiveness of various interpretive techniques in obtaining visitor compliance with park rules intended to protect natural resources.³

4.2.2.1 Impact intensity thresholds

Impacts are analyzed in terms of the potential for Alternatives B or C to improve or degrade the current availability of scientific knowledge and assistance that could be useful for interpretation related to natural resource protection.

No impact: The action results in no more or less new scientific knowledge or assistance to interpretive projects.

Negligible: The action results in a slight change in the availability of new scientific knowledge about park resources or scientific assistance to interpretation.

Minor: The action results in a noticeable change in the availability of new scientific knowledge about park resources or scientific assistance to interpretation.

Moderate: The action results in a readily apparent change in availability of new scientific knowledge about park resources or scientific assistance to interpretation.

Major: The action, if beneficial, results in an exceptional change in the availability of new scientific knowledge about park resources or scientific assistance to interpretation. If adverse, the action results in severely less scientific assistance for interpretation.

4.2.2.2 Contexts

Potential impacts to visitor experience and enjoyment are analyzed in three contexts as listed below:

- 1) Servicewide effects;
- 2) Effects to Yellowstone National Park; and
- 3) Effects to other individual parks (Chapter 3, Section 3.5.3 describes the park units most likely to be affected by Alternative B).

Yellowstone National Park was selected for a park-specific analysis because the historical patent record suggests that multiple discoveries with commercial application were based on research involving research material originating in Yellowstone (*see* Chapter 1, Section 1.2.4), which suggests that the majority of NPS benefits-sharing agreements could be established between researchers and Yellowstone.

4.2.3 Social Resources: The Research Community

Several thousand scientists conduct studies each year involving national park research specimens. Some of these researchers could be affected by the alternatives described in this DEIS. Information about them was compiled from servicewide NPS Research Permit and Reporting System (RPRS) records.

4.2.3.1 Impact intensity thresholds

Impacts to the research community are characterized in terms of potential changes in the conditions researchers may encounter when performing NPS-related research. To assess these changes, three parameters are analyzed to determine impacts: change in administrative burden; change in the potential for researchers to realize economic gains related to commercialization of their research results; and change in how research specimen collections are authorized. Beneficial impacts are those that make a positive change in those conditions (less work, more economic gains, or more lenient specimen collection criteria). Adverse impacts would make a negative change (more work, fewer economic gains, or stricter specimen collection criteria). The intensity of impacts to a researcher's potential to realize economic gains from research results is indicated by the analysis of potential monetary benefits but not characterized as negligible-to-major because of the unpredictable and wide variety of potential commercial applications for research results (*see* Chapter 1, Section 1.2.4).⁴

No impact: The action results in researchers' experiencing no change in administrative burden, potential economic gains, or research specimen collection authorization for researchers.

Negligible: The action results in researchers' experiencing a slight but nearly undetectable change in administrative burden or a change in research specimen collection authorization that does not alter researchers' ability to conduct research.

Minor: The action results in researchers' experiencing a slight but detectable change in administrative burden or a change in research specimen collection authorization; however, researchers may conduct similar research with specimens readily acquired elsewhere.

Moderate: The action results in researchers' experiencing a readily apparent change in administrative burden for researchers or a change in research specimen collection authorization. Researchers may conduct similar research with specimens acquired with difficulty elsewhere.

Major: The action results in researchers' experiencing an exceptional (beneficial) or severe (adverse) change in administrative burden for researchers or a change in research specimen collection authorization. Researchers cannot conduct similar research because specimens cannot be acquired elsewhere.

4.2.3.2 Contexts

Potential impacts to the research community are analyzed in five contexts as listed below:

- 1) Declared bioprospectors;
- 2) Inadvertent bioprospectors;
- 3) Undeclared bioprospectors;
- 4) Researchers who transfer NPS research specimens or other material originating as an NPS research specimen to third parties or who receive such transfers; and
- 5) All other researchers (*see* Chapter 3, Section 3.4).

4.2.4 Social Resources: NPS Administrative Operations

Potential impacts to NPS administrative operations are related to the administrative burden to the NPS anticipated to result from implementation of each alternative. Information about the administrative burden pertinent to each alternative is derived from available NPS Business Plans and the administrative effort associated with the commercial use of research results in academic institutions. Administrative effort is measured in terms of FTE, used in this DEIS to indicate the amount of work that can be performed in one year by one full-time employee. A beneficial impact would result if parks needed fewer FTE to perform administrative functions. An adverse impact would result if more FTE were required.

4.2.4.1 Impact intensity thresholds

Impacts are analyzed in terms of any changes in FTE required for administrative functions.

No impact: The action results in no changes in FTE required for administrative functions.

Negligible: The action results in a change equivalent to less than 10% of a park's available administrative FTE, or a very small number of FTE service-wide.

Minor: The action results in a change equivalent to at least 10%, but less than 20% of a park's available administrative FTE.

Moderate: The action results in a change equivalent to at least 20%, but less than 35% of a park's available administrative FTE.

Major: The action results in a change equivalent to at least 35% or more of a park's available administrative FTE.

4.2.4.2 Contexts

Potential impacts to NPS administrative operations were analyzed in three contexts as listed below:

- 1) Servicewide effects;
- 2) Effects to Yellowstone National Park (to learn why Yellowstone was selected for a park-specific analysis, *see* Section 4.2.1.2); and
- 3) Effects to other individual parks.

4.2.5 Impairment

In addition to determining the environmental consequences of the preferred and other alternatives, NPS policy requires analysis of potential effects to determine whether or not actions would impair park resources.⁵

The fundamental purpose of the National Park System, established by the National Park Service Organic Act and reaffirmed by the General Authorities Act, as amended, begins with a mandate to conserve park resources and values. NPS managers must always seek ways to avoid, or to minimize to the greatest degree practicable, adverse impacts on park resources and values. However, the laws do give the NPS the management discretion to allow impacts to park resources and values when necessary and appropriate to fulfill the purposes of a park, as long as the impact does not constitute impairment of the affected resources and values. Although Congress has given the NPS the management discretion to allow certain impacts within parks, that discretion is limited by the statutory requirement that the NPS must leave park resources and values unimpaired, unless a particular law directly and specifically provides otherwise. Prohibited impairment is an impact that, in the professional judgment of the responsible NPS manager, would harm the integrity of park resources or values, including the opportunities that otherwise would be present for the enjoyment of those resources or values. An impact to any park resource or value may constitute an impairment. An impact would be more likely to constitute an impairment to the extent that it affected a resource or value whose conservation is:

- Necessary to fulfill specific purposes identified in the establishing legislation or proclamation of the park;
- Key to the natural or cultural integrity of the park or to opportunities for enjoyment of the park; or
- Identified as a goal in the park's general management plan or other relevant NPS planning documents.

Impairment may result from NPS activities in managing the park, visitor activities, or activities undertaken by concessioners, contractors, and others operating in the park.

This DEIS analyzes the possible environmental impacts of choosing whether or not to implement a certain type of contract; hence, its affected environment and impact topics relate primarily to administrative functions of the NPS. Impairment analyses only apply to natural and cultural resource topics, and do not apply to topics involving visitor use, social resources, or park operations. Therefore, because this document does not carry forward natural or cultural resource topics, impairment will not be analyzed further in this DEIS.

4.2.6 Cumulative Impacts

The CEQ defines “cumulative impacts” as the impacts to the environment that result from the incremental impact of each action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.⁶ A cumulative scenario is a description of other past, present, and reasonably foreseeable future actions. The cumulative scenario for each impact topic is described in the impact analyses for Alternative A.

4.3 Alternative A: No Benefits-Sharing/No Action

Alternative A (No Benefits-Sharing/No Action) represents the current NPS approach to benefits-sharing when commercial use of new discoveries, inventions, and other valuable developments results from scientific research involving NPS resources. Under current practice, the NPS does not implement any benefits-sharing arrangements with the research community.

This alternative serves as a baseline against which to compare the other alternatives. The following sections examine the impacts of choosing not to implement benefits-sharing. Long-term impacts are analyzed over the 20-year period following implementation of the decision following this environmental analysis. This DEIS considers any change that is evident for five years or less to be short-term.

4.3.1 Impacts to Natural Resource Management

Sound management of park resources is the central NPS mission. Scientific research is a vital part of resource stewardship. The scientific contribution to natural resource management is described in Chapter 3, Section 3.2.

4.3.1.1 Servicewide impacts

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/No Action) would have neither adverse nor beneficial impacts on NPS natural resource management.

NPS programs and initiatives unrelated to benefits-sharing that impact natural resource management are reviewed in the cumulative scenario (Section 4.3.1.6). In the long term, these programs are expected to improve servicewide natural resource management, but Alternative

A's choice to not implement benefits-sharing will have no impact on natural resource management at the servicewide level.

4.3.1.2 *Yellowstone-specific impacts*

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/No Action) would have adverse impacts on Yellowstone National Park's natural resource management program.

Under Alternative A, the CRADA between Yellowstone National Park and Diversa Corporation, currently suspended, would be nullified. Non-monetary benefits would have been the primary benefit resulting from this CRADA. For example, under the terms of that CRADA, Diversa used its proprietary techniques and databases to perform two genetic analyses needed for Yellowstone natural resource management at no cost to the park (*see* Appendix F). Additional non-monetary benefits that would have accrued to Yellowstone during the remainder of the Yellowstone–Diversa CRADA's term would not occur under Alternative A. It is not known what these non-monetary benefits would have been.

All monetary benefits provided to Yellowstone by Diversa pursuant to the CRADA during the brief period of less than a year when the CRADA was active prior to suspension of the agreement would be returned to Diversa. The CRADA's provision for an up-front payment of \$20,000 per year for five years would have been equivalent in total to 1.14% of the FY2002 operational funding for natural resource management identified in Yellowstone's Business Plan (*see* Chapter 3, Section 3.2.2). Accordingly, the loss of this payment alone represents a quantitative short-term, adverse, negligible impact on Yellowstone's natural resource management program.

In addition, Diversa also would not make any performance-based payments to the park whether resulting from development of Pyrolase 200™ or from any other product Diversa has developed from its research activities involving material originally collected in Yellowstone (*see* Section 4.4.2.4 and Chapter 1, Section 1.2.4.2). The amount of these payments cannot be determined because Diversa's financial reporting obligations under the CRADA are also currently suspended, as are its invention disclosure and related reporting obligations to the NPS. As a result, it is not known whether Diversa has developed any additional products from its research activities involving material originally collected in Yellowstone that might generate additional payment obligations.⁷ Therefore, the intensity of the long-term adverse impact of Alternative A to Yellowstone natural resource management over the next 20 years cannot be determined.

4.3.1.3 *Individual park impacts*

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/No Action) would have neither adverse nor beneficial impacts on individual park natural resource management programs.

NPS programs and initiatives unrelated to benefits-sharing that impact natural resource management are reviewed in Section 4.3.1.6 (the cumulative scenario). In the long term, these programs are expected to improve natural resource management in the approximately 270 individual parks with significant natural resources, but Alternative A's choice to not

implement benefits-sharing will have no impact on natural resource management in any of these parks.⁸

4.3.1.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.3.1.5 Conclusion

Under Alternative A, the NPS would choose not to implement benefits-sharing. The NPS would continue to manage its natural resources with the scientific tools and knowledge made available to it through projects and programs unrelated to benefits-sharing. The wide variety of NPS programs that encourage production and use of scientific knowledge for natural resource management purposes would continue. Resource-management-based cooperative research projects with independent researchers would continue to be conducted.

Alternative A would have a negligible, short-term, adverse impact and a long-term adverse impact of unknown intensity to Yellowstone natural resource management, and no impacts to natural resource management servicewide or to other individual parks.

4.3.1.6 Cumulative impact scenario

Many actions unrelated to benefits-sharing also affect management of natural resources in the NPS by influencing the availability of useful scientific knowledge. The programs described below each serve to improve natural resource management by enhancing the availability of scientific knowledge necessary for effective park resource management decisions.

The most significant of these actions was the passage, in 1998, of the National Parks Omnibus Management Act (NPOMA). NPOMA specifically declares that scientific study is an authorized use of parks and directs the NPS to seek scientific knowledge for resource management purposes and also to allow study of park resources to the benefit of broader scientific goals. NPOMA directs the National Park Service to implement several of the programs that were subsequently incorporated into the NPS Natural Resource Challenge.

Initiated in 1999, the NPS Natural Resource Challenge requires active, informed management based on sound science. It enlists the skills and talents of research partners to develop the scientific information needed to make effective management decisions. In FY2004, the total annual funding for the Natural Resource Challenge was approximately \$73 million.

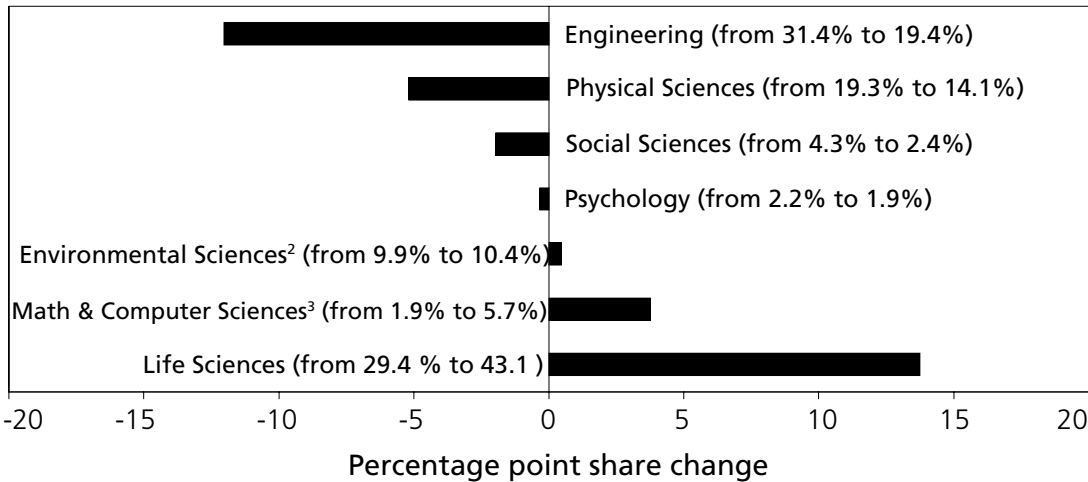
The linchpin of the NPS Natural Resource Challenge is the Inventory and Monitoring (I&M) Program, specifically required by NPOMA. The I&M Program provides the information needed to understand and measure performance regarding the condition of resources in parks, including the condition of watersheds, landscapes, marine resources, and biological communities. This information guides park management actions to improve and sustain the health of park resources. Based on the FY2006 budget proposal, by the end of FY2008, the I&M Program plans to identify the vital signs for natural resource monitoring in all 270 parks with significant natural resources and to have implemented vital signs monitoring in 80% (216 of 270) of those parks. In FY2006, the NPS requested \$4.9 million for this program.

The NPS participates in 17 Cooperative Ecosystem Studies Units (CESUs) to conduct cooperative multi-disciplinary research about NPS resources. CESU's are yet another program supported by the Natural Resource Challenge and required by NPOMA which provides research, educational opportunities, and technical assistance in the biological, physical, social, and cultural sciences necessary to manage NPS natural and cultural resources.⁹ As of August 2005, there were 13 federal agencies, 160 universities, and 39 other partners involved in CESUs.

Other actions that continue to have a significant influence on management of NPS natural resources include partnerships with scientists and other agencies to improve the scientific knowledge necessary for natural resource management decision-making. For example, in 56 parks, the NPS and USGS have water quality partnerships that provide information related to specific natural resource management needs for parks. Other partnerships, such as the USGS volcano observatories at several national parks and the national visibility monitoring network funded and operated by the U.S. Environmental Protection Agency, the NPS, individual U.S. states, and other land management agencies perform long-term monitoring of park conditions.

In all contexts (servicewide, Yellowstone National Park and other individual parks), NPS programs and initiatives to acquire new scientific knowledge for the management of natural

Figure 4.3.1.6. Changes in Field Shares of Total Federal Research Funding, 1970–1997¹



Note: Other sciences not classified within one of the broad fields listed above are excluded.
Source: National Science Foundation, Division of Science Resources Studies, Survey of Federal Funds for Research and Development.

¹This analysis deals with federal funds that support basic and applied research, but not development.
²In a number of surveys and reports, the designation earth, atmospheric, and oceanographic sciences is used in lieu of environmental sciences.
³These two fields were reported together through 1975.

Figure 4.3.1.6. In addition to a general increase in funding for research, the balance of federal research funding has shifted over the last three decades in favor of the life sciences. In 2003, life sciences research was estimated to account for 54% of federal research funding.¹⁰

resources, especially those related to NPOMA and the Natural Resource Challenge will continue to have beneficial impacts on management of natural resources.

In addition, actions entirely outside the control of the NPS also influence the availability of scientific knowledge for the management of natural resources. Because most of the research involving NPS resources is not funded by the NPS, decisions made by other funding entities affect the availability of scientific knowledge about parks resources. Many researchers who study park research specimens rely on grants from federal agencies to fund their work.¹¹ Federal obligations for research have grown at different rates for different disciplines, reflecting changes in perceived public needs in those fields, changes in available resources (e.g., scientists, equipment, and facilities), as well as differences in scientific opportunities across disciplines. As funding priorities have shifted to the life sciences, more funding has been available to researchers studying life sciences in parks. Since 78% of NPS research projects reported in 2001 were in the life sciences, this shift in federal funding emphasis may have had an impact on the scientific knowledge available for management of NPS natural resources.

4.3.1.7 Cumulative impacts

The cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on NPS natural resource management in all contexts by providing additional scientific knowledge for park management decisions. The negligible adverse impact Yellowstone might experience in the short-term over the return of monetary benefits to Diversa would not demonstrably alter the cumulative impact to Yellowstone's management of natural resources. Although the intensity of the long-term adverse impact of Alternative A to Yellowstone natural resource management cannot be determined, this impact would contribute to any other potential cumulative decreases. In all contexts, the impacts that result from not implementing benefits-sharing under Alternative A would not demonstrably add to the cumulative impact of actions outlined in the cumulative scenario.

4.3.2 Impacts to Visitor Experience and Enjoyment

Visitor experience and enjoyment can be affected by the quality and quantity of natural resource information provided to interpreters for use in developing interpretive services for visitors. NPS interpreters must rely on accurate and detailed information about park natural resources to become knowledgeable about the condition of their respective parks and their resources and for developing interpretive material for the public including effective programs, exhibits, and publications that optimize visitor experience and enjoyment. Under Alternative A, the NPS would continue to provide interpretive services to visitors using the available information from scientific research.

4.3.2.1 Servicewide impacts

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/No Action) would have neither adverse nor beneficial impacts on NPS visitor experience and enjoyment.

In the long term, the programs described in Section 4.3.2.6 are expected to provide additional natural resource knowledge for development of interpretive services, but Alternative A's

choice to not implement benefits-sharing will have no impact on visitor experience and enjoyment.

4.3.2.2 *Yellowstone-specific impacts*

The potential for Yellowstone-specific impacts is the same as described for the servicewide analysis in Section 4.3.2.1. Alternative A would result in no impacts.

4.3.2.3 *Individual park impacts*

The potential for individual park impacts is the same as described for the servicewide analysis in Section 4.3.2.1. Alternative A would result in no impacts.

4.3.2.4 *Mitigation measures*

The NPS has not identified any mitigation measures.

4.3.2.5 *Conclusion*

Under Alternative A, the NPS would choose not to implement benefits-sharing. The NPS would continue to plan and conduct interpretive services using the available scientific tools and knowledge. There would be no impacts to visitor experience and enjoyment as a result of implementing Alternative A.

4.3.2.6 *Cumulative impact scenario*

The cumulative scenario discussed in this section focuses on past, present and reasonably foreseeable actions that could affect visitor experience and enjoyment through potential impacts to NPS interpretive services at the servicewide, Yellowstone National Park and individual park level. When combined with the potential effects of each alternative individually, this scenario forms the basis of the cumulative effects analysis for this topic.

The National Park Service provides interpretive services to visitors at over 350 units of the National Park System as well as through the internet. In recent years, NPS interpretive services have been most significantly improved by the implementation of Comprehensive Interpretive Plans (CIP) and the NPS Interpretive Development Program (IDP). Individual parks prepare CIPs to identify priorities for park interpretative and educational programs and informational services with the express purpose of improving visitor experiences. IDPs define professional standards for NPS interpreters through a national benchmark curriculum. Along with a companion training aid, “Meaningful Interpretation: How to Connect Hearts and Minds to Places, Objects, and Other Resources,” IDPs have greatly improved the quality of interpretive services provided to the public. IDPs identify elements necessary for effective interpretation including knowledge of the resource, knowledge of the audience and application of appropriate techniques for interpretation.

In addition, parks use partnerships to expand or improve their interpretive services, thus improving visitor experiences. For example, Yellowstone National Park recently convened a group of scientific experts to plan and review the content of displays for two new visitor centers. In 2001, 62 parks reported progress within such partnerships. The recently established NPS Education Council is charged with expanding the NPS’s existing educational partnerships and establishing new ones which is expected to further improve visitor experiences.

Overall, the cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on visitor experience and enjoyment in all contexts by improving NPS interpretive services.

4.3.2.7 Cumulative impacts

Benefits-sharing would not be implemented under Alternative A, therefore no change to NPS interpretive services or additional impact on visitor experience and enjoyment would result in the Servicewide, Yellowstone, or individual park context. Alternative A provides no demonstrable addition to the total beneficial cumulative impact on visitor experience and enjoyment from actions outlined in the cumulative scenario.

4.3.3 Impacts to Social Resources: The Research Community

Under Alternative A, any qualified researcher would be eligible to obtain an NPS research permit in accordance with NPS regulations and guidelines, regardless of whether the research activities might lead to commercially valuable discoveries.

4.3.3.1 Impacts to declared, inadvertent, and undeclared bioprospectors

Under Alternative A, if valuable discoveries, inventions, and other developments resulting from study of research specimens lawfully collected from NPS units were commercially developed, the researcher's institution could realize economic gains without obligation to share any income with the NPS.¹² However, very few researchers—perhaps less than 0.5% of those holding NPS research permits—would be affected (*see* Chapter 3, Section 3.4). For this very small minority of researchers, the absence of a benefits-sharing obligation would be a long-term, negligible, beneficial impact (*see also* Section 4.4.4.1).

Under Alternative A, the Yellowstone–Diversa CRADA would be nullified and Diversa would have no benefits-sharing obligations to Yellowstone or the NPS. Accordingly, Diversa would experience a potentially long-term, negligible, beneficial impact.

4.3.3.2 Impacts to researchers who transfer or receive transferred NPS research specimens or other material originating as an NPS research specimen originally collected in a national park unit

Under Alternative A, researchers who transfer or receive transferred NPS research specimens or other material originating as an NPS research specimen that is not suitable for permanent retention as a museum collection would continue to work with the different forms, processes, and requirements unique to each park. Even without a standardized Material Transfer Agreement (MTA), the process is expected to take considerably less time than the 1.6 hours estimated for completion of a research permit application and Investigator's Annual Report (IAR), and be similar to the work required to transfer park-cataloged specimens through loan agreements. Accordingly, implementation of Alternative A would have a long-term, negligible, adverse impact on third-party researchers as well as to any researchers who wish to supply third-party researchers with research specimens.

4.3.3.3 Impacts to all other researchers

All other researchers would experience no impact from Alternative A's choice to not implement benefits-sharing.

4.3.3.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.3.3.5 Conclusion

Implementation of Alternative A would have long-term, negligible, beneficial impacts on researchers who make valuable discoveries during their research involving NPS scientific research specimens (some declared, some undeclared, and some inadvertent bioprospectors).

Implementation of Alternative A would have a long-term, negligible, adverse impact on researchers who transfer or receive transferred specimens originally collected in an NPS unit.

Implementation of Alternative A would have no impact on all other researchers.

4.3.3.6 Cumulative impact scenario

The most important factor influencing researchers who study material originating as an NPS research specimen is whether their proposed research project receives funding. The federal government's research funding priorities have the most impact on NPS permitted researchers because most NPS research permittees (81% in 2001) are either affiliated with federal institutions or affiliated with academic institutions that receive the majority of their research funding from the federal government.¹³ Future changes in funding availability cannot be foreseen in detail. Accordingly, funding changes could have either a beneficial or an adverse impact to the researchers described in this DEIS.

Equally important to researchers is the support offered them by the institution with which they are affiliated. Modern research is seldom conducted by a single individual in the field or at a desk. More often, research relies on sophisticated laboratories and the assistance of colleagues, students, and employees. Institutional support is usually essential for the performance of research. Because academic institutions are increasingly creating the infrastructure to translate research results into products that are distributed to the public through the marketplace, it is expected that institutional support of using NPS-related research results for commercial purposes will increase in the future, a beneficial impact to the researchers described in this DEIS.

Researchers are also influenced by the availability of scientifically significant resources for study. As home to relatively intact natural systems, the National Park System offers important opportunities for investigating scientific questions. The designation of 38 national park units as biosphere reserves and world heritage sites largely reflects the international scientific significance of these resources. The value of national parks as scientific laboratories will continue to grow in the face of accelerating local, regional, and global causes of environmental change and declining biological diversity, because the national parks contain precious information-gathering potentials that are not available anywhere else.¹⁴ Researchers who are able to study park resources experience a beneficial impact from the availability of NPS-protected resources for scientific study.

The most important past, present or future action affecting the researchers described in this DEIS is the availability of funding for research. Both institutional support and park resource availability are expected to provide beneficial impacts for these researchers; however changes

in funding availability, when combined with the impacts of other actions outlined in the cumulative scenario, could result in either a beneficial or adverse overall cumulative impact to the researchers described in this DEIS.

4.3.3.7 Cumulative impacts

The negligible impacts that result from the actions of Alternative A (negligible beneficial impacts to some declared bioprospectors, some undeclared bioprospectors, and inadvertent bioprospectors as well as negligible adverse impacts to researchers who participate in material transfers) would not demonstrably alter the cumulative impact of actions outlined in the cumulative scenario. The actions of Alternative A would have no impact to most researchers described in this DEIS, therefore there would be no demonstrable addition to the total cumulative impact these researchers experience from other sources.

4.3.4 Impacts to Social Resources: NPS Administrative Operations

Under Alternative A, the requirement contained in the standardized NPS research permit General Conditions for negotiation of benefits-sharing agreements prior to any use of research results for commercial purposes would be deleted and not enforced. In addition, Alternative A would not provide a standardized MTA for use by parks when authorizing transfers of NPS research specimens or other material originating as an NPS research specimen originally collected in a national park unit (*see* Chapter 1, Section 1.3.1).

4.3.4.1 Servicewide impacts

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/No Action) would have neither adverse nor beneficial impacts on NPS administrative operations.

Choosing not to provide a standardized MTA under Alternative A would continue to result in confusion within some parts of the NPS regarding when specimen transfer authorizations (other than permanently retained museum collections) must be requested and how to act upon such requests. Information relevant to estimating the number of specimen transfer authorizations issued servicewide and determining the impact of Alternative A is unavailable, because no systematic way has been established to conduct, manage, or report on them. However, the impact of choosing not to standardize MTAs is expected to be long-term, adverse, and negligible on NPS administrative operations.

4.3.4.2 Yellowstone-specific impacts

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/ No Action) would have neither adverse nor beneficial impacts on Yellowstone National Park's administrative operations.

Alternative A does not provide a servicewide standardized MTA for individual park use. However, Yellowstone National Park adopted a standardized MTA for specimen transfers in the year 2000. Although Yellowstone has an existing administrative workload from executing MTAs, Alternative A would make no change to this workload, and as a result there would be no impact to Yellowstone administrative operations (*see* Section 4.2.3).

4.3.4.3 Individual park impacts

Choosing not to implement benefits-sharing under Alternative A (No Benefits-Sharing/ No Action) would have neither adverse nor beneficial impacts on individual park administrative operations.

Alternative A does not provide a servicewide standardized MTA for individual park use and would not resolve the confusion some parks encounter regarding when to request specimen transfer authorizations and how to act upon such requests. Information for estimating the number of parks that might be affected is unavailable, because no systematic way has been established to conduct, manage, or report on these authorizations. However, in the long term, the impact of choosing not to standardize MTAs is expected to be adverse and negligible on individual park administrative operations.

4.3.4.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.3.4.5 Conclusion

Under Alternative A, the NPS would choose not to implement benefits-sharing or to introduce a servicewide standardized MTA. The result would be long-term, adverse, negligible impacts servicewide, no impacts to Yellowstone, and long-term, adverse, negligible impacts to individual parks.

4.3.4.6 Cumulative impact scenario

The cumulative scenario discussed in this section focuses on past, present and reasonably foreseeable actions that could affect NPS administrative operations at the servicewide, Yellowstone National Park and individual park level. When combined with the potential effects of each alternative individually, this scenario forms the basis of the cumulative effects analysis for this topic.

Impacts to NPS administrative operations were evaluated in this EIS by examining staffing (expressed in FTE's) needed to administer benefits-sharing agreements and comparing the requirements of each alternative to available FTEs. The most important general influence on NPS administrative staffing at all levels is the funding made available by annual Congressional appropriations. In the recent past, the annual appropriation for the Operation of the National Park System (ONPS) has risen from \$1.36 billion in FY2000 to an estimated \$1.68 billion in FY2005. Although ONPS funding has risen in recent years, so have various costs including wages. It is reasonable to expect that ONPS funding levels will fluctuate in the future. In addition, the proportion of ONPS funds allocated to the various functions of NPS operations cannot be foreseen in detail. These factors complicate characterization of the impacts of the cumulative scenario. Given these uncertainties, the cumulative impact analyses that follow draw on past experience and reasonably foreseeable actions related to NPS staffing levels.

4.3.4.7 Cumulative impacts

The negligible adverse impacts of Alternative A servicewide and to individual parks would not demonstrably alter the cumulative impact of other actions outlined in the cumulative scenario. The actions of Alternative A would have no impact to administrative operations

in Yellowstone National Park, therefore, Yellowstone would also experience no cumulative impacts associated with the actions of Alternative A.

4.3.5 Irreversible and Irretrievable Commitments of Resources

Alternative A reveals the possible environmental impacts of choosing not to implement a certain type of contract; hence, the nature of this DEIS is such that its affected environment and impact topics relate primarily to administrative functions of the NPS, rather than to natural or cultural resources. Therefore, Alternative A would not result in the long-term or permanent loss of any resources.

4.3.6 Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Alternative A applies to the role of the NPS in management of research results and not to the use or productivity of the environment. Neither short-term uses of the environment nor long-term productivity of the environment would be affected by actions proposed by Alternative A.

4.3.7 Adverse Effects that Cannot Be Avoided

The action of this alternative will not result in any greater-than-negligible adverse impacts.

4.4 Alternative B: Implement Benefits-Sharing

Under Alternative B, benefits-sharing could be expected to occur at Yellowstone National Park and other parks, especially those that are already aware of current or potential bioprospectors and those that have already hosted independent research activities (*see* Chapter 3, Section 3.5.3). Long-term impacts are analyzed over the 20-year period following implementation of the alternative. This DEIS considers any change that is evident for five years or less to be short-term.

The NPS has identified CRADAs as the agreement type for implementing benefits-sharing under Alternative B (*see* Chapter 2, Section 2.3).

4.4.1 Possible “Benefits” in Benefits-Sharing Agreements

Under Alternative B, two different types of benefits could accrue to the NPS: non-monetary and monetary. Non-monetary benefits could include knowledge and research relationships, training and education, research-related equipment, or special services (such as laboratory analyses). Monetary benefits could generally take two forms: up-front funding for research projects that support the park’s research activities or performance-based payments paid as a percentage of any CRADA-related income received by a researcher’s institution.¹⁵

All benefits received by the NPS under any type of benefits-sharing agreement would be dedicated to the conservation of resources protected and managed by the NPS.

Individual park units that are federal laboratories would retain and use the benefits from a benefits-sharing agreement. The Federal Technology Transfer Act of 1986 (FTTA) provides for the disposition of royalties or other income resulting from developments arising from CRADA-related cooperative research.¹⁶ Any funds received by the NPS from CRADA-related activities would be managed in compliance with these provisions.¹⁷

Table 4.4.1. Potential benefit types and timing generated by a single CRADA

	Short-term	Long-term
Non-monetary	Knowledge and research relationships, training or education, research-related equipment, or special services	Some non-monetary benefits possible
Up-front monetary	Funding for park research (not expected in every agreement)	n/a
Performance-based monetary	Payment based on researcher’s “other license income” related to licensing of intermediate research results	Payment based on researcher’s income related to commercial use of research results (e.g., royalties on product sales)

Table 4.4.1. The potential benefits that could be generated by a benefits-sharing agreement are summarized in Table 4.4.1, discussed below in Sections 4.4.1.1–4.4.1.3, and discussed in more detail in Appendix C.

4.4.1.1 Non-monetary benefits

The NPS has identified four types of non-monetary benefits that could occur under some or all benefits-sharing agreements: knowledge and research relationships, training and education, research-related equipment, and special services (such as laboratory analyses).

The NPS expects that non-monetary benefits would be the primary benefit resulting from any benefits-sharing agreement. Non-monetary benefits could help address the goal of “science for parks” identified as a primary component of the Natural Resource Challenge. The NPS cannot afford to fund all of the research required for the problem-solving needs of the National Park System, some of which could be provided as non-monetary benefits (see Chapter 3, Section 3.2). For most parks, a benefits-sharing agreement that provided non-monetary benefits could represent a substantial increase in the amount of scientific knowledge either directly reported by independent scientists or discovered with their support (see also Chapter 3, Section 3.2). Each non-monetary benefit can add materially to a park’s ability to protect its resources and therefore meet the fundamental purpose of the National Park System, which begins with a mandate to conserve park resources and values.¹⁸

Non-monetary benefits, such as scientific equipment for research to answer management related questions and improved knowledge about park resources, would also be particularly useful for improving the NPS's consideration of all reasonably foreseeable environmental effects of its proposed actions, as recommended by the Council on Environmental Quality (*see* Chapter 3, Section 3.2).

Each benefits-sharing agreement would be individually negotiated, and the particular knowledge and capabilities of the benefits-sharing researcher partner would determine the specific non-monetary benefits for each agreement. Accordingly, the expected values of non-monetary benefits in agreements were not assigned a hypothetical dollar equivalent value for this analysis.

Four types of non-monetary benefits were identified as likely to occur under some or all benefits-sharing agreements.

Knowledge and research relationships

The NPS believes that the benefits derived from the sharing of resource knowledge and the establishment of enhanced collaborative research relationships would be the most valuable component of a benefits package. The potential knowledge and research relationships from a benefits-sharing agreement could have both quantitative and qualitative dimensions. Quantitatively, the value of knowledge might be measured in dollars that the NPS otherwise would have had to expend to produce the same information. Qualitatively, the importance of information about park resources can be greater than the simple cost to produce information would indicate. In addition, the improved relationship between an independent researcher and the NPS that could be created by a benefits-sharing agreement could lead to unexpected and substantial benefits to the NPS. The value of these qualitative dimensions cannot be quantified.

Training and education

The value of training or education could have both quantitative and qualitative dimensions. Quantitatively, the value might be measured in dollars that the NPS otherwise would have had to expend to obtain the same training and education for its employees. Qualitatively, the value added to a park, or to the NPS, as a result of a person gaining training or education can be substantially greater than the initial cost of the training. For example, if an NPS employee attends a workshop about natural resource management, that employee might make a recommendation that saves a park many times the cost of the original training, because better decisions today can lower future costs. However, in terms of value added, the value of training and education, though substantial, cannot be quantitatively calculated.

Research-related equipment

The complete "value" of research-related equipment received by a park could have quantitative and qualitative dimensions. Quantitatively, its value might be measured in dollars that the NPS otherwise would have had to expend to obtain the same research-related equipment, and would be reported under Alternative B. Qualitatively, the value of research-related equipment can be greater than its initial retail value, because that equipment can be put to work on behalf of the park for a substantial amount of time. For example, a camera provided to a park and used to document wildlife migration could provide a resource

management value many times greater than the retail cost of the camera. However, the additional value attributable to the use of otherwise unavailable research-related equipment, though substantial, cannot be quantitatively calculated.

Special services

Special services are specialized work functions for which the NPS has no equivalent function. In such cases, the NPS either relies on contractors to produce these services when needed or foregoes their acquisition entirely. Common examples include DNA analysis and/or chemical and biochemical analysis. The value of these special services could have both quantitative and qualitative dimensions. Quantitatively, their value might be measured in dollars that the NPS otherwise would have had to expend to obtain the same special services through contracting. This quantitative retail value would be reported under Alternative B. However, the qualitative value of special services could be even greater. For example, the DNA analyses performed by Diversa on the Yellowstone wolf population had a retail cost equivalent, but the real value of these analyses included the production of new knowledge with substantial qualitative dimensions. New information was revealed about wolf reproductive relationships in the wild; managers can use that information to assess the genetic health of the population (*see* Appendix F).

4.4.1.2 Monetary benefits

Potential annual monetary benefits were estimated both in cumulative terms for the entire proposed benefits-sharing program and in terms of a single benefits-sharing agreement. Appendix C contains a detailed discussion of how these estimates were developed. The average potential monetary benefits displayed in Tables 4.4.1.2-1 and 4.4.1.2-2 should not be interpreted as a prediction of the specific monetary benefits that would result from any actual benefits-sharing agreement. Instead, they represent the range of potential monetary benefits that informs the impact analyses later in this chapter.

Cumulatively, the estimated potential monetary benefits under Alternative B would be larger with each succeeding year (*see* Table 4.4.1.2-1).

Table 4.4.1.2-1. Range of potential cumulative monetary benefits used to analyze the potential impacts of a proposed NPS benefits-sharing program, servicewide and Yellowstone contexts

Year	Low range estimated annual benefits	Mid-range estimated annual benefits	High range estimated annual benefits	High range with a high value annual royalty (<i>see</i> Appendix C, Section C.8.3)
Year 1	\$24,313	\$48,626	\$97,252	no royalties expected this year
Year 5	\$121,565	\$243,130	\$486,260	no royalties expected this year
Year 10	\$268,178	\$536,357	\$1,206,803	\$2,206,803
Year 20	\$634,712	\$1,269,424	\$2,856,204	\$3,856,204

A single CRADA is estimated to yield between \$0 and \$24,000 annually in the short term and between \$0 and \$155,000 (and, though unlikely, could yield more than \$1,000,000) annually in the long term. The amount could vary considerably in any given year (*see* Table 4.4.1.2-2).

Table 4.4.1.2-2. Estimated range of potential monetary benefits used to analyze the impacts of a proposed NPS benefits-sharing program on individual parks other than Yellowstone

Duration of potential impact	Potential annual payment	% of agreements likely to yield this average benefits level (see Appendix C, Section C.9.3)	See Appendix C (Sections referenced) for the derivation of this estimate
Short-term impact analysis	0	29%	Model Two (Section C.8.2)
	\$700	22%	Model Two (Section C.8.2)
	\$24,000	50%	Model One (Section C.8.1)
Long-term impact analysis	0	77%	Both models
	\$4,000	12%	Model Two (Section C.8.2)
	\$155,000	12%	Model One (Section C.8.1)
	\$1,000,000	0.6%	High-value royalty analysis (Section C.8.3)

4.4.2 Impacts to Natural Resource Management

Under Alternative B, the potential impacts to natural resource management of implementing benefits-sharing agreements would be expected to focus primarily on natural resources, because all of the NPS-related research results known to have been used for commercial purposes relate to the field of biology. Accordingly, it is likely that all benefits-sharing researchers would be biologists, and their assistance would be most suitable for natural resource management. These impacts could have both quantitative and qualitative dimensions.

4.4.2.1 Impact analysis common to all contexts (servicewide, Yellowstone, and individual parks): research trends in the NPS

During scoping, several commenters suggested that selection of the benefits-sharing alternative (Alternative B) could affect the quantity of research activities in parks by either attracting or discouraging scientific research activities by bioprospectors. Although these comments seemed generally based on a misassumption that bioprospecting activities are currently prohibited in parks, bioprospecting research in fact has always been possible in parks, allowed under the same regulations that control all types of scientific research activities. Implementation of benefits-sharing as proposed in Alternative B would not change the criteria by which all scientific research permit applications are evaluated. The following analysis addresses the potential foreseeable impact of Alternative B on research trends.

Four datasets were examined to determine whether there had been a measurable impact on the quantity of research in parks after the announcement of the Yellowstone–Diversa benefits-sharing agreement in 1997 (*see* Appendix E). These are the best available data with which to examine the possibility that researchers would be either attracted or discouraged by the selection of Alternative B. They were:

- The quantity of Scientific Research and Collecting Permits issued by Yellowstone, 1992–2001;
- The quantity of research reports (IAR) submitted to Yellowstone, 1992–2001;

- The quantity of research reports submitted to the 38 parks that received at least one research report each year from 1992 through 2001 (these parks accounted for half (50.3%) of all the research reports received by a total of 270 parks during this period); and
- The quantity of research reports submitted to the NPS servicewide, 1992–2001.

For each dataset, the number of research reports submitted (or, in one case, research permits issued) during the period 1992–1997 (prior to initiation of the Yellowstone–Diversa agreement) was compared to the number submitted during 1998–2001 (the post-benefits-sharing time period). No significant difference in the number of research projects conducted in any context was detected between the pre-benefits-sharing and post-benefits-sharing time periods. These data indicate that the announcement or publicity surrounding the 1997 Yellowstone–Diversa agreement did not result in either an increase or decrease in NPS research reports or permits.¹⁹ Therefore, it is likely that implementing Alternative B would have no impacts on natural resource management relative to research trends, except in the case of Alternative B1 (*see* Section 4.4.2.2).

4.4.2.2 Impact analysis common to all contexts (servicewide, Yellowstone and individual parks): impacts specific to Alternatives B1, B2, or B3

In response to public concerns, Alternative B provides three different ways that implementation of benefits-sharing could treat financial information such as royalty rates. The effects of these three variations on natural resource management are captured within the general impact analysis for Alternative B. However, their differences are analyzed in some detail here to provide a basis for choice among these variations.

Impacts specific to Alternative B1 (always disclose all monetary terms)

Under Alternative B1, the NPS would treat the rate at which performance-based payments were made, as well as related financial information contained in a benefits-sharing agreement, as public information, not as confidential business information. Parties to potential agreements would be advised that all terms and conditions contained in the text of an agreement (including negotiated performance-based payment rates and other financial information) would be released to the public upon request. Accordingly, under Alternative B1, the NPS would not be privy to any financial information the researcher wished to keep confidential.

Alternative B1 could have four effects. It could (1) limit payment equitability, (2) create an artificial “rate ceiling,” (3) discourage some research, and (4) discourage establishment of benefits-sharing agreements.

This mandatory disclosure would limit the NPS’s ability to negotiate “equitable” performance-based payment rates as specified by the National Parks Omnibus Management Act of 1998. Negotiations would depend heavily on a good-faith representation by the researcher’s institution of its ability to offer potential monetary benefits, because the researcher’s institution would not disclose financial information to the NPS that it wished to keep proprietary.

Disclosure of performance-based payment rates could result in possible establishment of an artificial “rate ceiling” without regard to factors that could justify higher or lower rates under specific facts and circumstances.²⁰ This could affect the amount and timing of monetary benefits actually provided to the NPS (*see* Chapter 4, Section 4.4.1.3).

These disclosure requirements could discourage both declared and undeclared bioprospectors from applying for NPS research permits to study park resources in anticipation of potential disclosure of negotiated royalty rates or other sensitive information normally considered to be proprietary financial information.²¹ Any resulting reduction in research reports (IARs) submitted to parks could represent a potential loss of resource knowledge that would have been useful to natural resource managers.

Implementation of Alternative B1 could reduce the number of benefits-sharing agreements established in the NPS compared to Alternatives B2 and B3, because researchers might not want to expose themselves to potentially substantial economic and competitive harm resulting from mandatory disclosure of performance-based payment rates and related financial information that could otherwise be exempt from disclosure under Exemption 4 of the Freedom of Information Act (FOIA), which requires federal agencies to withhold “trade secrets and commercial or financial information obtained from a person and privileged or confidential” when responding to FOIA requests.²²

Alternative B1 could result in long-term impacts less beneficial for natural resource management programs than under Alternatives B2 and B3.

Although the number of such researchers who could refrain from studying park resources or from entering into benefits-sharing agreements under Alternative B1 cannot be derived from available information, it is anticipated that any potential loss of monetary benefits is captured within the estimated range of monetary benefits presented in this DEIS (*see* Section 4.4.1.2).

Impacts specific to Alternative B2 (evaluate disclosure of monetary terms on case-by-case basis)

Under Alternative B2, all benefits-sharing agreements would be made available to the public in their entirety upon request, unless one or more agreement parties objected to the release of any specific information for reasons satisfying one or more of the statutory disclosure exemptions provided under FOIA.²³

Implementation of Alternative B2 would avoid the four effects of Alternative B1; it would not limit payment equitability, create an artificial “rate ceiling,” discourage some research, or discourage establishment of benefits-sharing agreements.

Alternative B2 would not limit the NPS’s ability to negotiate “equitable” performance-based payment rates or create an artificial “rate ceiling,” because the researcher’s institution would be free to disclose financial information to the NPS that it wished to keep proprietary (*see* previous discussion of Alternative B1). Implementation of Alternative B2 would have no impact on any researcher’s private proprietary interest otherwise entitled to protection under FOIA. Accordingly, in contrast to Alternative B1, Alternative B2 would not discourage either declared or undeclared bioprospectors from applying for NPS research permits to study

park resources. Alternative B2 would not restrict the number of potential benefits-sharing agreements.”

Alternative B2 could result in long-term impacts more beneficial for natural resource management than under Alternatives B1, and the same as Alternative B3. This could affect the estimate of monetary benefits provided in this DEIS. The impact of Alternative B2 on potential monetary benefits is captured within the estimates provided in this DEIS.

Impacts specific to Alternative B3 (never disclose monetary terms)

Under Alternative B3, no royalty rate or related financial information would be released to the public under any circumstances. Therefore, implementation of Alternative B3 would avoid the four effects of Alternative B1; it would not limit payment equitability, create an artificial “rate ceiling,” discourage some research, or discourage establishment of benefits-sharing agreements (*see* previous discussion of Alternative B1).

Alternative B3 could result in long-term impacts more beneficial for natural resource management programs than under Alternative B1, and the same as Alternative B2. This could affect the estimate of monetary benefits provided in this DEIS. The impact of Alternative B3 on potential monetary benefits is captured within the estimates provided in this DEIS.

4.4.2.3 Servicewide impacts

Qualitative impacts

The NPS expects that the most significant potential impacts from implementing benefits-sharing agreements would be new knowledge about natural resources and new research collaborations that would result from benefits-sharing agreements with members of the research community. Non-monetary benefits (*see* Section 4.4.1.1) could be used by the NPS to improve natural resource management activities, primarily in parks that entered into benefits-sharing agreements.

From a servicewide perspective, non-monetary benefits would work cumulatively with existing servicewide initiatives to increase and improve the use of science for natural resource management programs. Because the important role that microbes play in ecosystems is becoming more widely recognized, information that independent researchers could provide about park microbes would be particularly useful. For example, it is reasonable to expect that benefits-sharing partners could contribute to the NPS’s Inventory and Monitoring (I&M) Program and to individual park Vital Signs Monitoring. Accordingly, Alternative B’s impacts are expected to be long-term, beneficial, and negligible-to-major.

Quantitative impacts

It is expected that monetary benefits would increase over time as both the number of agreements and the value of research results increased (*see* Figure 4.4.2.3-1).

Figure 4.4.2.3-1. Range of Cumulative Potential Monetary Benefits of an NPS Benefits-Sharing Program

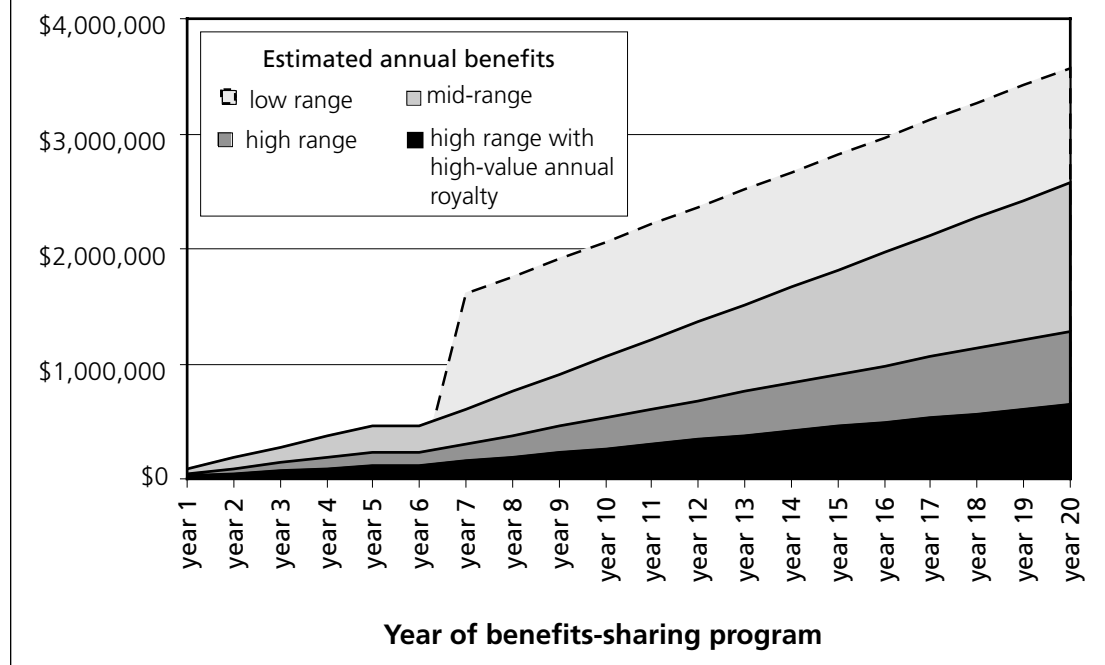


Figure 4.4.2.3-1. An NPS benefits-sharing program could generate monetary benefits that would increase over time because CRADAs would obligate researchers to make performance-based payments and such obligation would survive termination of the CRADA.

To provide a servicewide perspective, the total amount of estimated monetary benefits was compared to the budget for the Natural Resource Challenge. In 2004, the Natural Resource Challenge program accounted for approximately \$73 million of the NPS budget.²⁴ This comparison is presented in the table below.

Table 4.4.2.3. All potential monetary benefits compared to the \$73 million NPS Natural Resource Challenge funding, FY2004

Year	Low range estimated annual benefits	Mid-range estimated annual benefits	High range estimated annual benefits	High range with a high-value annual royalty (see Appendix C, Section C.8.3)
1	0.03%	0.07%	0.15%	No royalties expected this year
5	0.17%	0.33%	0.75%	No royalties expected this year
10	0.37%	0.74%	1.65%	3.02%
20	0.87%	1.74%	3.91%	5.29%

Table 4.4.2.3. The comparison of potential monetary benefits generated by an NPS benefits-sharing program to the FY2004 funding for the NPS Natural Resource Challenge is provided in this table (see *also* Appendix C).

In the short term (represented by year 5 in Table 4.4.2.3), it is expected that the monetary benefits from an NPS benefits-sharing program could range from approximately \$122,000 to \$547,000, which would be equivalent to no more than 0.75% of the funding derived from the Natural Resource Challenge in FY2004. Accordingly, potential short-term monetary benefits would represent short-term, beneficial, negligible impacts to servicewide natural resource management.

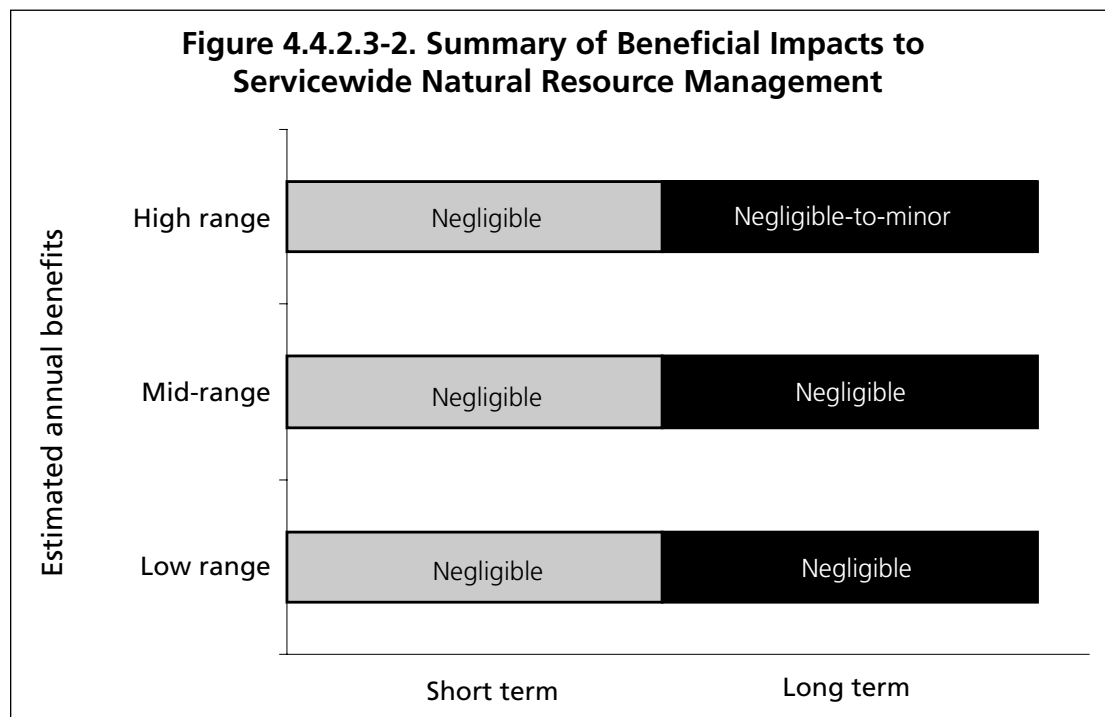


Figure 4.4.2.3-2. Monetary benefits could have a negligible and, in some instances, minor beneficial impacts on servicewide natural resource management.

In the long-term (year 20 in Table 4.4.2.3), it is expected that the monetary benefits from an NPS benefits-sharing program could range from approximately \$635,000 to more than \$3.8 million, which would be equivalent to a range of approximately 1–5% of the funding derived from the Natural Resource Challenge in FY2004. Accordingly, potential long-term monetary benefits would represent long-term, beneficial, negligible-to-minor impacts to servicewide natural resource management.

4.4.2.4 Yellowstone-specific impacts

Under Alternative B, it is possible that an estimated 2–9 new benefits-sharing agreements per year would be implemented in Yellowstone National Park (*see* Chapter 1, Section 1.2.4 and Chapter 3, Section 3.5.3). In addition, implementation of Alternative B would generate immediate non-monetary and monetary benefits to Yellowstone National Park as a result of implementation of the Yellowstone–Diversa CRADA, which has been suspended since March 1999 (*see* Appendix G).

Qualitative impacts

The impact of non-monetary benefits to Yellowstone's natural resource management program from an estimated 2–9 new benefits-sharing agreements per year cannot be foreseen in detail, because each benefits-sharing partner would have individual knowledge and capabilities to offer.

However, the Yellowstone–Diversa CRADA provides a single example of the kind of benefits that could result. Under the terms of that CRADA, Diversa used its proprietary techniques and databases to perform two genetic analyses needed for Yellowstone natural resource management at no cost to the park (*see* Appendix F). These types of analyses, which are hard for the NPS to accomplish because of the cost and the expertise required, are sometimes relatively easy for a private company to do. These non-monetary benefits, which were invaluable to Yellowstone's wolf restoration program, occurred because of the working collaboration between park scientists and private scientists that had been fostered and required by the Yellowstone–Diversa CRADA. Accordingly, Alternative B's impacts are expected to be long-term, beneficial, and minor-to-major.

Quantitative impacts

Under Alternative B, the CRADA between Yellowstone National Park and Diversa Corporation, currently suspended, could become active, and Diversa could make payments of \$20,000 each year for five years to Yellowstone, as well as performance-based payments to the park resulting from development of Pyrolase 200™ (*see* Chapter 1, Section 1.2.4.2). The amount of these payments cannot be determined unless the CRADA is reinstated, because Diversa's financial reporting obligations to Yellowstone under the CRADA are also currently suspended, as are its invention-disclosure and related reporting obligations. As a result, Yellowstone does not know whether Diversa has developed any additional products from its research activities at Yellowstone that might generate additional payment obligations.

The initial benefits period payment of \$100,000 over five years would be equivalent to 1.14% of the FY2002 operational funding for natural resource management that was identified in Yellowstone's Business Plan (*see* Chapter 3, Section 3.2.2). Accordingly, this payment alone could have a short-term, beneficial, negligible impact on Yellowstone's natural resource management program.

Individual natural resource management projects could be affected to a greater extent than this programmatic evaluation indicates. For example, Yellowstone's natural resource managers have identified a range of natural resource management activities that require approximately \$100,000 in funding to accomplish.²⁵ These include:

- One year of comprehensive parkwide air quality monitoring;
- Initiation and completion of the first complete cave inventory for the entire park;
- Four years of identifying, monitoring, and protection of the park's fossil forests;
- Five years of operation and upgrading of the geothermal microbe database;
- Research related to the restoration of one new, wild population of imperiled westslope cutthroat trout;
- Five years of monitoring of bald eagle or peregrine falcon nesting success; and

- Funding one three-year PhD and one two-year MS studies on any desired resource topic.

Diversa's payment obligations under the CRADA are both short- and long-term. The minimum \$100,000 payment would be short-term, reflecting the amount due for the initial five-year period provided by the CRADA, and would be paid whether or not Diversa used their research results for any commercial purpose. Any additional performance-based payments (e.g., royalties) would be paid for an indefinite, long-term future period, because the payment obligations resulting from development of valuable commercial applications from research results survive termination of the CRADA.

For purposes of this analysis, the estimated amounts shown in Table 4.4.1.3-1 were compared to Yellowstone's natural resource management funding as presented in its Business Plan. In FY2002, Yellowstone had \$8.8 million available for natural resource management.

If all NPS CRADAs and resulting monetary benefits were received by Yellowstone alone (which is possible), and used entirely for research in support of natural resource management activities, the park could experience widely ranging monetary benefits of between \$0 and more than \$1 million annually. There could be short-term, beneficial, negligible impacts, represented by year 5 in Table 4.4.2.4 below, and long-term, beneficial, negligible-to-major impacts, represented by year 20. These conclusions are presented in the table below and summarized in Figure 4.4.2.4, below.

Table 4.4.2.4. Potential monetary benefits equivalent to a percentage of Yellowstone natural resource management funding level, FY2002

Year	Low range estimated annual benefits	Mid-range estimated annual benefits	High range estimated annual benefits	High range with a high value annual royalty (see Appendix C, Section C.8.3)
1	0.3%	0.6%	1.2%	no royalties anticipated this year
5	1.4%	2.8%	6.2%	no royalties anticipated this year
10	3.0%	6.1%	13.7%	25.1%
20	7.2%	14.4%	32.5%	43.8%

Table 4.4.2.4. If all of the NPS's monetary benefits were received by Yellowstone alone and used entirely for natural resource management activities, they could represent the equivalent of less than 1–44% of Yellowstone's FY2002 natural resource management funding level.

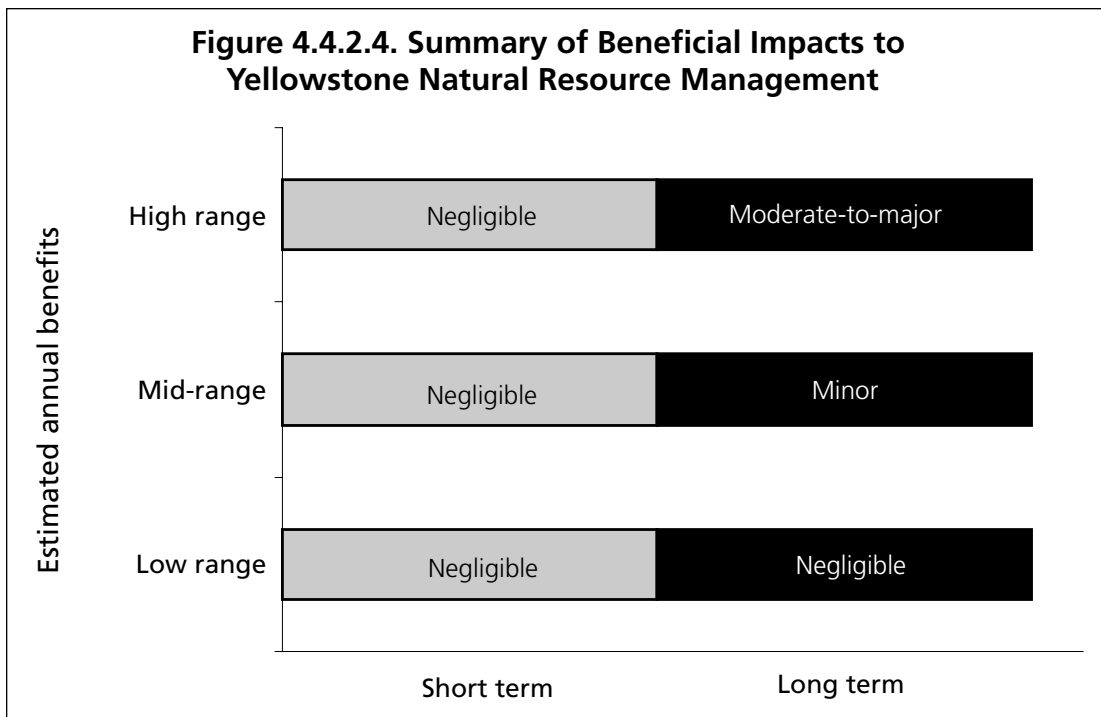


Figure 4.4.2.4. The monetary benefits derived from benefits-sharing program could have a negligible short-term beneficial impact on Yellowstone natural resource management and a long-term negligible-to-major beneficial impact.

4.4.2.5 Individual park impacts

Park-specific impact analysis was based upon the potential impact of a single benefits-sharing agreement on a park's natural resource management program (*see* Section 4.2.1.2 and Chapter 3, Section 3.5.3).

Qualitative impacts

The most significant non-monetary benefit that can be foreseen for most parks with a benefits-sharing agreement would be their ability to draw on the scientific expertise of benefits-sharing partners. Because all of the known park-related patents involve biology, it is likely that the majority of this expertise would be biological (*see* Chapter 1, Section 1.2.4).

Examples of expert provisions from which natural resource managers could benefit include genetic analyses of species of concern to park managers, research on wildlife diseases, impact assessments of proposed projects in parks, contributions to an individual park's I&M program, and participation in planning for natural resource restoration projects (*see also* Chapter 3, Section 3.2.1). Accordingly, Alternative B's impacts are expected to be long-term, beneficial, and negligible-to-major.

Quantitative impacts

The potential income generated by a single benefits-sharing agreement and the potential timing of payments were characterized previously (*see* Table 4.4.1.2-2, above).

A park with a single benefits-sharing agreement could experience widely ranging monetary benefits of between 0 and more than \$1 million annually. These estimates were compared to the funding levels for park natural resource management programs as presented in 43 Business Plans (*see* Chapter 3, Section 3.2.2). The potential impacts on natural resource management of the range of potential monetary benefits are shown in Table 4.4.2.5 below (*see* Appendix C for a detailed presentation regarding the derivation of the figures displayed in Table 4.4.2.5).

Table 4.4.2.5. Beneficial impacts to natural resource management at 43 representative parks*

If a park received:		Number of parks that would experience:				
		No impact	Negligible	Minor	Moderate	Major
Short-term annual payment	\$0	43	-	-	-	-
	\$4,000	-	42	1	-	-
	\$155,000	-	7	11	8	17
Long-term annual payment	\$0	43	-	-	-	-
	\$4,000	-	42	1	-	-
	\$155,000	-	7	11	8	17
	\$1,000,000	-	3	1	1	38

*The potential annual monetary benefits of a single CRADA at a single park are compared to the natural resource management funding available per park. The levels of potential monetary benefits under analysis vary in their foreseeable likelihood. For example, 50% of agreements are expected to yield an average of \$24,000 annual monetary benefits during the first five years of the agreement (the short-term benefits period), but only 0.6% of agreements are expected to yield more than \$1 million annually (*see* Appendix C).

Table 4.4.2.5. Potential beneficial impacts of monetary benefits to individual park natural resource management programs ranges from no impact to major impact.

Impacts to parks that received monetary benefits during the immediate benefits period could range from negligible to major, with the majority of parks experiencing no more than negligible impacts. Impacts to parks that received monetary benefits during the deferred benefits period could also range from negligible to major. Accordingly, quantitative impacts to individual parks would be short or long-term, beneficial, and range from none to major, because not all of the parks studied would receive monetary benefits.

4.4.2.6 Mitigation measures

No mitigation is needed for potential beneficial impacts. The only adverse impacts to natural resource management that are anticipated are from a potential reduction in independent research under Alternative B1 and its accompanying reduction in the provision of scientific information to the NPS, but the extent or importance of such potential reduction cannot be estimated from available information.

4.4.2.7 Conclusion

Under Alternative B, the NPS could have additional scientific tools and knowledge to manage its natural resources. Additional opportunities could become available for supporting resource management-based cooperative research projects with independent researchers. Potential long-term impacts of Alternative B on NPS natural resource management could be more beneficial than Alternative A (No Benefits-Sharing/No Action) in every context.

Servicewide, the potential impacts of implementing benefits-sharing agreements to natural resource management could qualitatively be long-term, beneficial, and negligible-to-major. Quantitatively, they could be long-term, beneficial, and negligible-to-minor. From a resource conservation standpoint, the potential impacts of non-monetary benefits to NPS units could be of greater value than the quantitative monetary analysis suggests.

In Yellowstone, the potential impacts of implementing benefits-sharing agreements to natural resource management could qualitatively be long-term, beneficial, and minor-to-major. Quantitatively, they could be both short-term, beneficial, and negligible, and long-term, beneficial, and negligible-to-major.

At the individual park level, the potential impacts of implementing benefits-sharing agreements to natural resource management could qualitatively be long-term, beneficial, and negligible-to-major. Quantitative impacts to individual parks could be short or long-term, beneficial, and none-to-major (because not all of the parks studied would receive monetary benefits).

Alternative B1 could result in long-term, less beneficial impacts relative to natural resource management than Alternatives B2 and B3, because under Alternative B1, a small number of researchers could be expected to avoid park research and the mandatory disclosure would limit the NPS's ability to negotiate "equitable" performance-based payment rates. The intensity of such a reduction of beneficial impacts cannot be known from available information.

4.4.2.8 Cumulative impacts

The Cumulative Scenario was described in Section 4.3.2.6.

The cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on NPS natural resource management in all contexts by providing additional scientific knowledge for park natural resource management decision-making. Alternative B's impacts on natural resource management are also beneficial for this same reason. However, servicewide, the impacts that result from this alternative would make no demonstrable addition to the cumulative impact of other past, present and reasonably foreseeable actions outlined in the cumulative scenario. Individual parks with benefits-sharing agreements could experience a greater than negligible beneficial cumulative impact under this alternative.

4.4.3 Impacts to Visitor Experience and Enjoyment

Park interpretation serves a primary resource preservation role by facilitating public understanding of and participation in the stewardship of park resources. Under Alternative B,

all benefits received through benefits-sharing agreements would be dedicated to conservation purposes. Accordingly, specific interpretive services designed to enhance visitors' understanding of and participation in meeting natural resource management goals would qualify for use of benefits.

Qualitative impacts

Potential qualitative impacts to visitor experience and enjoyment are related to the degree to which Alternative B would provide scientific knowledge and expertise to NPS interpreters.

Quantitative impacts

Monetary benefits derived under a CRADA would only be available to park interpretive divisions for research-related uses, and are captured in the impact analysis for natural resource management (*see* Section 4.4.2). Examples of interpretive-related natural resource research could include site-specific research conducted to determine the effectiveness of various interpretive techniques in obtaining visitor compliance with park rules intended to protect natural resources.²⁶

4.4.3.1 Servicewide impacts

The NPS expects that the most significant potential impacts to visitor experience and enjoyment under Alternative B would result from non-monetary benefits, which could be used to improve interpretive services, primarily in the parks that entered into benefits-sharing agreements. These non-monetary benefits would include additional knowledge and information about park resources and increased recognition of the societal value associated with scientific research involving NPS units.²⁷ Interpreters could use this additional information and knowledge about park resources to improve interpretive services.

Alternative B would require researchers to provide a non-monetary benefit to the NPS by informing the NPS of all valuable discoveries developed under a benefits-sharing agreement.²⁸ Enhanced recognition of the value of NPS resources to ongoing scientific discoveries that can benefit humanity could help underscore for park visitors the value to society of conserving natural resources in NPS units in an unimpaired condition. This type of recognition could improve visitor stewardship of natural resources. Additional non-monetary benefits would result from the enhanced research relationships developed between benefits-sharing partners and parks.

Accordingly, the servicewide impacts of Alternative B are expected to be long-term, beneficial, and at least negligible, with a possibility of being minor.

4.4.3.2 Yellowstone-specific impacts

The impact of non-monetary benefits to Yellowstone interpretation cannot be foreseen in detail. Each benefits-sharing partner would have different knowledge and capabilities to offer. However, it is reasonably foreseeable that the majority of benefits-sharing partners would be microbiologists (*see* Chapter 1, Section 1.2.4).

Yellowstone National Park's Interpretive Division currently recognizes and explains to visitors the importance of the microbial components of the Yellowstone ecosystem. For example, recent planning for two new visitor education centers included consulting with

microbiologists, and Montana State University's Thermal Biology Institute recently agreed to help Yellowstone's education program with curriculum development.

Yellowstone's visitor interpretive services could also benefit from custom-designed reports from researchers detailing the significance of their discoveries in layperson's terms with photos or other visual aids. Additional non-monetary benefits would result from the enhanced research relationships developed between benefits-sharing partners and Yellowstone under Alternative B.

Alternative B's impacts to visitor experience and enjoyment in Yellowstone are expected to be long-term, beneficial, and negligible-to-minor.

4.4.3.3 Individual park impacts

Park-specific impact analysis was based upon the potential impact of a single benefits-sharing agreement on a park.

The impact of non-monetary benefits to park interpretation from a single benefits-sharing agreement cannot be foreseen in detail, because each benefits-sharing partner would have individual knowledge and capabilities to provide through benefits-sharing agreements under Alternative B.

The non-monetary benefits described in "servicewide impacts," above, could apply to any park with a benefits-sharing agreement. For certain parks, the value of potential non-monetary benefits could be moderate compared to their currently available resources. The most important non-monetary benefit that can be foreseen for most parks would be that parks could draw on the expertise of benefits-sharing partners. For example, it is reasonable to expect that benefits-sharing partners could provide site-specific information or visual aids about natural resources as well as actively participating in planning for interpretive services.²⁹ Accordingly, Alternative B's impacts to visitor experience and enjoyment are expected to be long-term, beneficial, and negligible-to-moderate.

4.4.3.4 Mitigation measures

No mitigation is needed for potential beneficial impacts.

4.4.3.5 Conclusion

Qualitatively, the impacts of Alternative B could be long-term, beneficial, and negligible-to-minor servicewide and for Yellowstone, and long-term, beneficial, and negligible-to-moderate for other individual parks.

The quantitative impacts of implementing benefits-sharing agreements on visitor experience and enjoyment derive from interpretive-related natural resource research that benefits-sharing could support. They are captured in the impact analysis for natural resource management (*see* Section 4.4.2).

4.4.3.6 Cumulative impacts

The cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on visitor experience and

enjoyment in all contexts by improving NPS interpretive services. The beneficial impacts that result from implementing benefits-sharing under Alternative B would add to the total beneficial cumulative impact outlined in the cumulative scenario. Servicewide and for Yellowstone, the negligible-to-minor beneficial impacts of Alternative B could add negligibly to the total cumulative impact. The negligible-to-moderate beneficial impacts of Alternative B to some other individual parks could result in a more than negligible beneficial cumulative impact to other parks that entered into a benefits-sharing agreement.

4.4.4 Impacts to Social Resources: The Research Community

The research community would be affected by Alternative B's requirement to enter into a benefits-sharing agreement before using research results for commercial purposes when research involved study of NPS specimens.

Under Alternative B, there would be no change in how research specimen collection is authorized. Parks would authorize research specimen collection the same way they do now: any qualified researcher would be eligible to obtain an NPS research permit in accordance with regulations and guidelines, regardless of whether the research activities might lead to commercially valuable discoveries. Therefore, under Alternative B, there would be no additional impacts to the research community related to the existing research permitting process.

A standardized MTA would be implemented for third-party transfers of research material when the material is not cataloged as part of a museum collection because it will be consumed in analysis.

4.4.4.1 Impacts to declared bioprospectors

Approximately 0.5% of NPS research permit holders in 2001 were declared bioprospectors (*see* Chapter 3, Section 3.4.3.2). Because the NPS proposal provides that terms of the non-monetary and monetary benefits in benefits-sharing agreements would be negotiated and mutually agreeable to both parties, it is reasonable to expect that the potential economic impacts of an agreement would not rise above a negligible adverse effect on researchers or their institutions. It is anticipated that most declared bioprospectors would be affiliated with organizations such as academic institutions or corporations with experienced technology transfer offices. These researchers could rely on the technology transfer expertise already present in their institutions, thus reducing any adverse workload impacts on the researchers.

Benefits-sharing agreements would foster a collaborative relationship between researchers and NPS scientists that could have beneficial impacts for researchers. For example, the inadvertent bioprospector described as an example in Section 3.4.3.2 has explained that his discovery was based in part on a conversation with a park employee.

Overall impacts to declared bioprospectors are expected to be long-term, adverse, and negligible.

In addition, under Alternative B, the benefits-sharing agreement between Yellowstone National Park and Diversa Corporation would be amended to conform to the standardized

CRADA provided in Appendix A of this DEIS should they wish to re-establish their partnership. This would not constitute any foreseeable additional impact to Diversa.

4.4.4.2 Impacts to inadvertent and undeclared bioprospectors

Few NPS research projects have been identified by park staff as undeclared bioprospecting (see Chapter 3, Section 3.4.3.2).³⁰

Alternative B would have no impacts on inadvertent and undeclared bioprospectors until and unless they actually prepared to use their research results for commercial purposes. At that time, they would be required to declare their position as bioprospectors and enter into a benefits-sharing agreement with the NPS. Hence, they would become declared bioprospectors, and be subject to those impacts.

4.4.4.3 Researchers who transfer or receive transferred NPS research specimens or other material originating as an NPS research specimen

Currently, there is no standardized process or format for requesting NPS authorization of third-party transfers of research specimens that will be consumed during analysis and are therefore not suitable for permanent retention as museum specimens. Standardization of MTAs is expected to reduce the workload associated with making such requests by streamlining the process and eliminating additional paperwork associated with multiple versions of MTAs issued by individual parks, thus providing a beneficial impact to researchers. The workload for researchers to complete an MTA would be substantially less than the 1.6 hours required to obtain an NPS research permit. The impacts to these researchers are considered to be long-term, beneficial, and negligible.

4.4.4.4 All other researchers

For all other researchers, implementing benefits-sharing agreements would result in no impacts.

4.4.4.5 Impacts specific to Alternatives B1, B2, and B3

Impacts specific to Alternative B1 (always disclose all monetary terms)

During scoping, some members of the public advised the NPS to design a benefits-sharing program with full disclosure of all terms and conditions of benefits-sharing agreements, including all financial details. Under Alternative B1, there could be economic and competitive impacts to certain researchers and institutions whose otherwise confidential proprietary financial information was disclosed as required by the terms of the agreement.

The U.S. District Court for the District of Columbia ruled in 2002 that disclosure of otherwise confidential royalty rates in a CRADA over the objections of a CRADA party could constitute substantial harm that FOIA Exemption 4 was enacted to prevent. The court made its finding based on evidence presented by the National Institutes of Health that the overwhelming majority of its CRADA partners and other licensees objected to the release of otherwise confidential CRADA royalty rates based on demonstrations that the release of such information could cause substantial economic and competitive harm (see Chapter 1, Section 1.7.6). The court also found that many research firms would refuse to participate in CRADA-related research if otherwise confidential royalty rate information were disclosed.³¹ Accordingly, to avoid disclosing what they consider to be proprietary information, some

proportion of declared and undeclared bioprospectors could abandon or never begin studies involving NPS-related research specimens. In these ways, implementation of Alternative B1 could result in long-term impacts more adverse to the research community than under Alternatives B2 and B3.

Impacts specific to Alternative B2 (evaluate disclosure of monetary terms on a case-by-case basis)

Under Alternative B2, all benefits-sharing agreements would be made available to the public in their entirety upon request, unless one or more agreement parties objected to the release of any specific information for reasons satisfying one or more of the statutory disclosure exemptions provided under FOIA. Accordingly, Alternative B2 would avoid any adverse impact to researchers from release of proprietary information that could be harmful to the researcher's interests.

Implementation of Alternative B2 would have no impact on any researcher's private proprietary interest otherwise entitled to protection under FOIA. Accordingly, in contrast to Alternative B1, implementation of Alternative B2 could result in long-term impacts less adverse to the research community than under Alternative B1, and the same as under Alternative B3.

Impacts specific to Alternative B3 (never disclose monetary terms)

Under Alternative B3, no performance-based payment rate or related financial information would be released to the public under any circumstances. Therefore, implementation of Alternative B3 would have no impact on any researcher's private proprietary interest. Accordingly, Alternative B3 would avoid any adverse impact to researchers from release of proprietary royalty rate or financial information that could be harmful to the researcher's interests. Accordingly, in contrast to Alternative B1, implementation of Alternative B3 could result in long-term impacts less adverse to the research community than under Alternative B1, and the same as under Alternative B2.

4.4.4.6 Mitigation measures

Alternative B prevents greater-than-negligible adverse impacts to benefits-sharing partners by providing that terms of the non-monetary and monetary benefits in benefits-sharing agreements would be negotiated and mutually agreeable to both parties. This would make it possible to produce agreements that are not unduly burdensome to researchers while still benefiting the NPS.³²

4.4.4.7 Conclusion

Any potential for greater-than-negligible adverse impacts from benefits-sharing obligations would be prevented by adhering to mutually agreed terms negotiated for agreements consistent with the standardized terms provided in the CRADA proposed in Alternative B.

For declared bioprospectors, implementing benefits-sharing agreements would result in long-term, adverse, negligible impacts.

For inadvertent and undeclared bioprospectors, implementing benefits-sharing agreements would result in no impacts.

For researchers who transfer or receive transferred NPS research specimens or other material originating as an NPS research specimen, implementing benefits-sharing agreements would result in long-term, beneficial, negligible impacts.

For all other researchers, implementing benefits-sharing agreements would result in no impacts.

Alternative B1 could result in long-term, more adverse impacts to the research community than Alternatives B2 and B3.

4.4.4.8 Cumulative impacts

The negligible impacts that result from the actions of Alternative B (negligible beneficial impacts to researchers who participate in material transfers as well as negligible adverse impacts to declared bioprospectors) would not demonstrably alter the cumulative impact of actions outlined in the cumulative scenario. Alternative B would have no impact to all other researchers, therefore there would be no demonstrable addition to the total cumulative impact these researchers experience from other sources.

4.4.5 Impacts to Social Resources: NPS Administrative Operations

Under Alternative B, individual parks would negotiate, implement, and monitor compliance with benefits-sharing agreements consistent with their current management of a variety of agreements with other entities. Although most monetary benefits would be dedicated to scientific activities promoting the conservation of natural resources protected and managed by the NPS, monetary benefits could also be used to offset administrative costs of a benefits-sharing agreement in accordance with the FTTA.³³

The workload reported by the Association of University Technology Managers (AUTM) Annual Licensing Survey for personnel in university-based licensing offices can be used to indicate the potential administrative burden for managing NPS benefits-sharing agreements. Unlike the AUTM survey respondents, NPS personnel would not be responsible for soliciting benefits-sharing partners, marketing research results, or start-up activity efforts (starting a new company based on an academic discovery). Accordingly, the AUTM workload covers more functions than would be necessary for the NPS and provides a generous estimate of the work that would be required to administer benefits-sharing agreements.

In 2001, AUTM reporting institutions required a total of 717.91 FTE for a variety of activities associated with licensing. In that year, 4,058 new licenses were executed out of a total of 22,939 licenses administered. If all the reported FTE had simply been used for executing new licenses, then each new license would have averaged a 0.18 FTE workload. Because of the variety of activities included in the AUTM FTE figure, the 0.18 FTE is a generous estimate of the workload to execute a single new benefits-sharing agreement.³⁴

4.4.5.1 Servicewide impacts

The potential servicewide impact of administering a benefits-sharing program was determined by examining the FTE needed to administer agreements. If parks servicewide

established two, four, or nine new benefits-sharing agreements in one year, the FTE required for that purpose would range from 0.36 to 1.62 FTE. For this reason, the potential impacts to servicewide NPS administrative operations would be long-term, adverse, and negligible in all reasonably foreseeable cases.

Yellowstone National Park has used MTAs since the year 2000, at an average workload of 1 hour and 30 minutes each to execute.³⁵ Information relevant to evaluating the number of MTAs that have been executed servicewide is unavailable, because no systematic way has been established to conduct, manage, or report on these authorizations. However, the impact of adding standardization to the current requirement to authorize third-party transfers of NPS research specimens or other material originating as an NPS research specimen is expected to be long-term, beneficial, and negligible.

Table 4.4.5.1. Potential servicewide benefits-sharing administrative burden			
	2 new agreements annually	4 new agreements annually	9 new agreements annually
Number of FTE needed	2 x 0.18 = 0.36	4 x 0.18 = 0.72	9 x 0.18 = 1.62
Impact	Negligible	Negligible	Negligible

Table 4.4.5.1. The administrative burden of executing benefits-sharing agreements remains low under every predicted level of program implementation.

4.4.5.2 Yellowstone-specific impacts

In 2002, Yellowstone National Park had 108.9 available FTE for administration and management. If Yellowstone established between two and nine benefits-sharing agreements in one year, the FTE required for that purpose would range from 0.36 to 1.62, and would represent, at most, 1.5% of available administration and management FTE. For this reason, the potential impacts to NPS administrative operations of implementing benefits-sharing agreements in Yellowstone would likely be long-term, adverse, and negligible in all reasonably foreseeable cases.

Because Yellowstone National Park has used standardized MTAs since 2000, their servicewide introduction would have no impact in this context.

Table 4.4.5.2. Potential Yellowstone benefits-sharing administrative burden

	2 new agreements annually	4 new agreements annually	9 new agreements annually
Number of FTE needed	$2 \times 0.18 = 0.36$	$4 \times 0.18 = 0.72$	$9 \times 0.18 = 1.62$
Percentage of available FTE (of 108.9)	0.3%	0.7%	1.5%
Impact	Negligible	Negligible	Negligible

Table 4.4.5.2. Under all predicted levels of benefits-sharing, the adverse impact to Yellowstone administration would be negligible.

4.4.5.3 Individual park impacts

Most parks would not enter into any benefits-sharing agreements, and would experience no impacts to park operations.

Other than Yellowstone, 31 of the 44 park Business Plans previously described include information about existing administrative resources.³⁶ The number of available administrative FTE per park varies considerably (*see* Table 4.4.5.3, below). If individual parks established a single benefits-sharing agreement, the FTE required for that purpose would represent, at most, 3.75% of available FTE. It is possible that a park might not contain the in-house expertise necessary to enable it to negotiate a benefits-sharing agreement. In such a case, the park would draw on the technical assistance resources described in Section 4.4.5.5. In some cases, a CRADA could provide up-front payments that could be used to offset administrative costs. For these reasons, the potential impacts of implementing benefits-sharing agreements to NPS administrative operations at the individual park level could be long-term, adverse, and negligible in all reasonably foreseeable cases.

The impact of adding standardization to the current requirement to authorize third-party transfers of NPS research specimens or other material originating as an NPS research specimen is expected to be long-term, beneficial, and negligible.

Table 4.4.5.3. Potential individual park benefits-sharing administrative burden (one benefits-sharing agreement)

Park code	Available FTE	Percentage of available FTE		Park Code	Available FTE	Percentage of available FTE
GUMO	4.8	3.75%		CAHA	16.1	1.12%
WHSA	5.1	3.53%		BIBE	16.4	1.10%
VICK	6.1	2.95%		VAFO	18.9	0.95%
WRST	6.9	2.61%		REDW	22.1	0.81%
TIMU	7	2.57%		GETT	22.2	0.81%
BAND	8	2.25%		CHOH	22.9	0.79%
APIS	8.5	2.12%		ZION	23	0.78%
BADL	9.5	1.89%		OLYM	26.5	0.68%
LAVO	9.7	1.86%		INDU	27.4	0.66%
VOYA	10.5	1.71%		EVER	31	0.58%
OZAR	10.6	1.70%		GRTE	31	0.58%
ISRO	10.6	1.70%		DENA	34.2	0.53%
BRCA	10.8	1.67%		GLCA	35.8	0.50%
VIIS	11.9	1.51%		GRCA	54	0.33%
JOTR	13.9	1.29%		GOGA	90.8	0.20%
ACAD	14.1	1.28%				

Table 4.4.5.3. Administration of a single benefits-sharing agreement would be a long-term, negligible, adverse impact for all parks studied.

Administration of a single benefits-sharing agreement would represent a negligible long-term impact for most parks. The most time-consuming period for agreement administration would be in the period during which negotiations occurred and the agreement was established. Monitoring an agreement during the immediate benefits period (on average, five years) would require less administrative effort than establishing a new agreement. Monitoring an agreement during the deferred benefits period would require even less administrative effort. Accordingly, the actual potential impacts to individual parks may be less adverse than estimated here.

4.4.5.4 Impacts specific to Alternatives B1, B2 or B3

Impacts specific to Alternative B1 (always disclose all monetary terms)

Under Alternative B1, proprietary business information (including but not limited to the rate at which performance-based payments would be made to the NPS) in a benefits-sharing agreement would always be disclosed. Because researchers might not want to expose themselves to the potential substantial economic and competitive harm resulting from mandatory disclosure of royalty rates and related financial information that could otherwise be exempt from disclosure under FOIA Exemption 4 (*see* Section 4.4.4.5), they either might not provide that information to the NPS or they might decide not to conduct research involving study of NPS specimens. Accordingly, implementation of Alternative B1 could reduce the effectiveness or number of benefits-sharing agreements established in the NPS when compared to Alternatives B2 and B3.

In addition, both declared and undeclared bioprospectors considering park research proposals could be discouraged from applying for NPS research permits to study park resources in anticipation of a potential benefits-sharing agreement requirement to disclose what they consider to be proprietary financial information. Accordingly, the impacts on NPS administrative operations of implementing Alternative B1 could be less adverse (require less work) than Alternative B2 or B3. The NPS believes that the breadth of the estimated range of the number of new benefits-sharing agreements each year (two, four, or nine) is adequate to include the potential impact of Alternative B1.

Impacts specific to Alternative B2 (evaluate disclosure of monetary terms on case-by-case basis)

Under Alternative B2, the NPS would consider individual requests to withhold or release proprietary business information regarding the rate at which performance-based payments would be made to the NPS or related financial information on a case-by-case basis. For example, FOIA Exemption 4 authorizes federal agencies to withhold “trade secrets and commercial or financial information obtained from a person and privileged or confidential” when responding to FOIA requests.³⁷

Under Alternative B2, all benefits-sharing agreements would be made available to the public in their entirety upon request unless one or more agreement parties objected to the release of any specific information for reasons satisfying one or more of the statutory disclosure exemptions provided under FOIA.

Implementation of Alternative B2 would not reduce either the potential number of benefits-sharing agreements established in the NPS or the number of applications for NPS research permits compared to Alternatives B1 and B3. Alternative B2 also would have no additional impact on NPS administrative operations beyond that already identified for Alternative B. The NPS believes that the estimated range of the number of new benefits-sharing agreements each year (two, four, or nine) is adequate to include the potential impact of Alternative B2.

Impacts specific to Alternative B3 (never disclose monetary terms)

Under Alternative B3, proprietary business information (including but not limited to rates at which performance-based payments would be made to the NPS) in a benefits-sharing agreement would never be disclosed.

Implementation of Alternative B3 would not reduce either the number of benefits-sharing agreements established in the NPS or the number of applications for NPS research permits compared to Alternatives B1 and B3. In contrast to Alternative B1, Alternative B3 would have no additional impact on NPS administrative operations beyond that already identified for Alternative B. The NPS believes that the estimated range of the number of new benefits-sharing agreements each year (two, four, or nine) is adequate to include the potential impact of Alternative B3.

4.4.5.5 Mitigation measures

Several mitigation measures would minimize adverse impacts to NPS administrative operations and prevent and avoid adverse impacts to the NPS research permit issuance decision procedures. Protecting research permit issuance decisions from being

inappropriately influenced by benefits-sharing considerations will also protect park resources and values from potential adverse impacts by ensuring that such decisions continue to adhere to the strict standards in place for the issuance of NPS research permits.

Professional and financial assistance

Mitigation measures would be applied to protect parks from undue impacts from excessive workloads associated with benefits-sharing or associated with a park's unfamiliarity with executing a benefits-sharing agreement. As provided in Alternative B, the NPS would provide technical assistance to parks with negotiation of benefits-sharing agreements and related issues.³⁸ NPS personnel with specialized benefits-sharing expertise would be available to park superintendents upon request in addition to the routine assistance available for every park contract or agreement from a Department of the Interior solicitor.

In addition, the authority in the FTTA to recover costs for administration of CRADAs would mitigate adverse impacts to NPS administrative operations.³⁹

Workload

NPS implementation of standardized MTAs to authorize third-party transfers of research specimens that have not been cataloged into NPS museum collections would help to minimize administrative burdens and, as such, any adverse impacts on NPS administrative operations.⁴⁰ The average workload associated with the proposed MTAs has not been established; however, Yellowstone National Park has used MTAs since the year 2000 at an average workload of 1 hour and 30 minutes each to execute.⁴¹ No estimate has been made for this DEIS of the number of MTAs that would be executed servicewide, because no systematic way has been established to conduct, manage, or report on these authorizations.

Guarding against inappropriate influence (management accountability and control)

In the absence of any mitigation measures, implementation of Alternative B could result in consideration of separate benefits-sharing issues at the time NPS research permits are issued, or at least in the perception of such consideration. For example, some people would allege that some park officials might be inclined to approve a permit based on the applicant's representation that valuable research results were likely, whereas other park officials might be inclined to disapprove permit applications involving commercial research firms for reasons not related to the scientific merits of the proposed research activity. Therefore, mitigation measures would be applied to protect permit issuance decisions from being inappropriately influenced by benefits-sharing considerations. This would protect park resources and values from potential adverse impacts by ensuring that park research coordinators continue to adhere to the strict standards in place regarding the issuance of research permits. Mitigation efforts would use management controls to manage the risk that benefits sharing might inappropriately influence research permitting decisions.⁴² They would include the following:

Compliance with law

Current regulations guard against benefits-sharing having an inappropriate influence on research permitting decisions. Permits concerning activities that could impact NPS natural resources are issued by park superintendents pursuant to well-established NPS regulations (36 CFR 1.6 and 2.5) and NEPA guidance

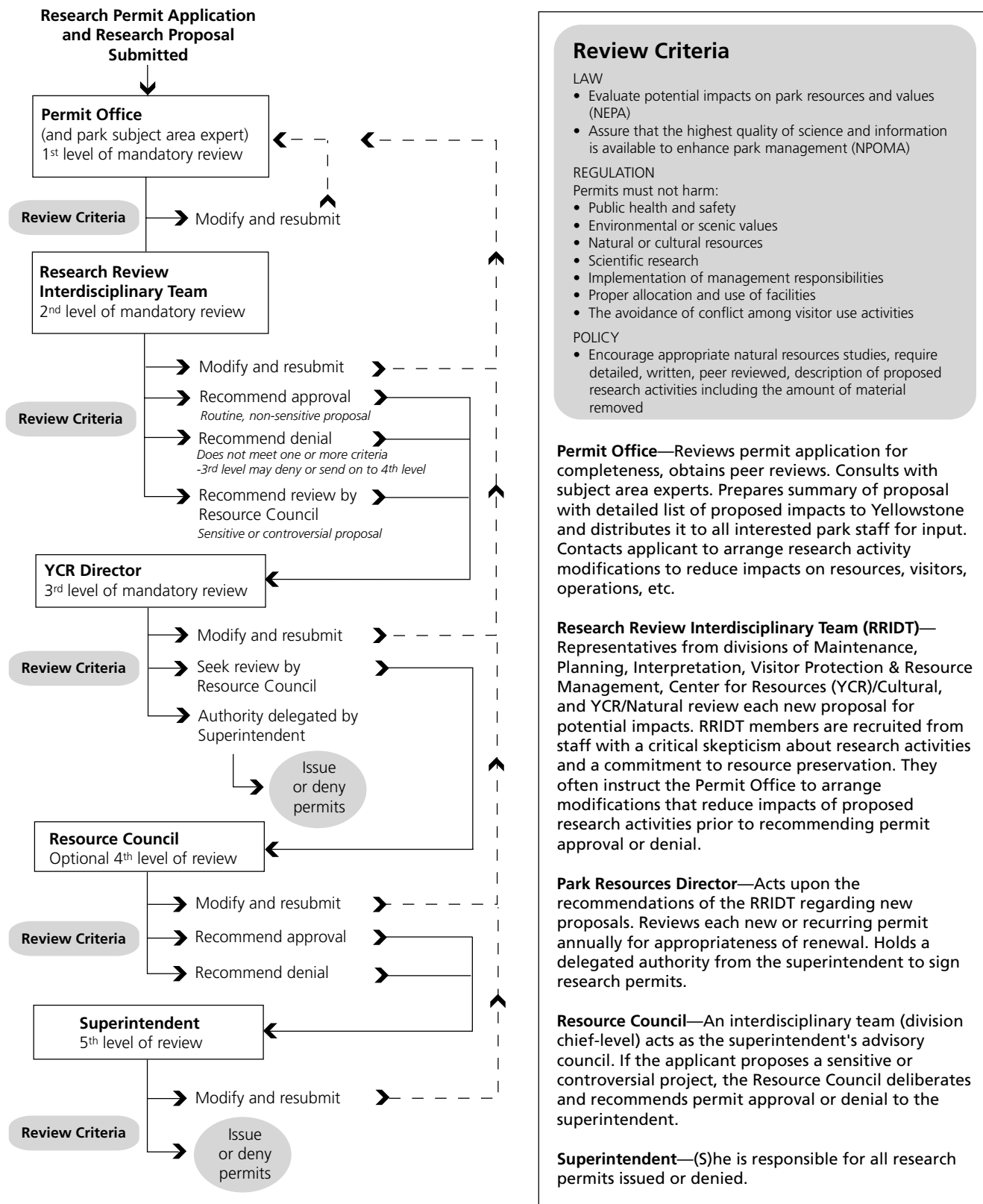
(Director's Order 12) that would not be affected by implementation of Alternative B. These regulations and policy directives would continue to protect NPS natural resources against impairment or other adverse impacts by applying the mitigation considerations provided in 36 CFR 1.6. These considerations provide that permits for the collection of research specimens from NPS units are issued to qualified applicants based on findings by park superintendents that issuance of a permit would not have adverse impacts on:

- Public health and safety;
- Environmental or scenic values;
- Natural or cultural resources;
- Scientific research;
- Implementation of NPS management responsibilities;
- Proper allocation and use of NPS facilities; or
- Avoidance of conflict among visitor use activities.

Furthermore, research permit applications are reviewed in accordance with NEPA, which provides additional protection against occurrence of adverse impacts to natural resources.

Alternative B would not change these regulations and practices that mitigate against improper issuance of NPS research permits. As an example of the way NPS research permit applications are reviewed, the procedures used by Yellowstone National Park are shown on the next page.

Figure 1. Research permit review procedures, Yellowstone National Park



Delegation of authority and organization

As suggested by the U.S. Office of Management and Budget (OMB), an appropriate organizational structure would be established to effectively carry out program responsibilities.⁴³

Three organizational procedures would prevent consideration of benefits-sharing issues at the time of NPS decisionmaking regarding research permit applications:

- 1) Benefits-sharing agreements would not authorize specimen collection in parks.⁴⁴
- 2) Although park superintendents would be the ultimate decisionmakers in both cases, separate individuals would manage preparation of research permit issuance decisions and benefits-sharing negotiations.
- 3) Research permit issuance would precede and remain separate from negotiation of any benefits-sharing agreement.

This separation of the access (research permit) and benefits-sharing decisionmaking processes would ensure that there would be no inappropriate influence resulting from benefits-sharing considerations on the research permitting process.

Parks would be provided with technical assistance from NPS personnel with specialized benefits-sharing expertise. Such technical assistance would lend a servicewide perspective in implementing benefits-sharing, thereby ensuring that benefits-sharing agreements would be consistent, equitable, and efficient throughout the National Park System. As suggested by OMB, it would also function as a guard against individuals exceeding or abusing their assigned authorities.⁴⁵

These mitigation measures also would be applied to any future actions that are guided by this DEIS. The NPS would comply with appropriate environmental review requirements under NEPA and any other relevant legislation for any future actions.

4.4.5.6 Conclusion

Entering into benefits-sharing agreements would be likely to produce long-term, adverse, negligible impacts to administrative operations in all contexts: servicewide, Yellowstone, and individual parks. Implementation of mitigation measures could prevent adverse impacts from rising to a minor level for parks with small staffs.

The implementation of mitigation measures that separate permit decisionmaking from benefits negotiation would prevent the NPS from making decisions about issuance of research permits based upon speculative consideration of possible benefits-sharing.

Impacts from using MTAs would be long-term, beneficial, and negligible servicewide and in individual parks, and would have no impacts in Yellowstone.

Implementation of Alternative B1 would result in fewer benefits-sharing agreements and accordingly less adverse impacts than B2 or B3 in all three contexts.

4.4.5.7 Cumulative impacts

The negligible adverse impacts of entering into benefits-sharing agreements under Alternative B in all contexts would not demonstrably alter the cumulative impact of other actions outlined in the cumulative scenario. In addition, technical assistance to parks and the cost-recovery provisions of the FTTA are anticipated to mitigate adverse impacts to the administrative workload associated with benefits-sharing agreements (see Section 4.4.5.5).

The negligible beneficial impacts of using standardized MTAs under Alternative B servicewide and in other parks would not demonstrably alter the cumulative impact of other actions outlined in the cumulative scenario. Using standardized MTAs would have no impact to administrative operations in Yellowstone National Park, therefore, Yellowstone would also experience no cumulative impacts associated with this action of Alternative B.

4.4.6 Irreversible and Irretrievable Commitments of Resources

Alternative B would not result in the temporary or permanent loss of any resources.

4.4.7 Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Alternative B applies to the management of research results. Long-term productivity of the environment would be unaffected by actions proposed by Alternative B.

4.4.8 Adverse Effects that Cannot Be Avoided

The action of this alternative will not result in any greater-than-negligible adverse impacts.

4.5 Alternative C: Prohibit Research Specimen Collection for Any Commercially Related Research Purposes

Alternative C would prohibit specimen collection for commercially-related research and prohibit commercial development of research results involving NPS research specimens unless determined by the NPS director to be in the public interest. These prohibitions would not be retroactive; therefore, there would be no impacts related to NPS Scientific Research and Collecting Permits signed before Alternative C's proposed regulatory change (*see* Chapter 2).

Alternative C would also provide standardized MTAs to parks for completing third-party transfers of research material originating as specimens collected under the authorization of an NPS research permit and not suitable for permanent retention as part of a museum collection.⁴⁶ Impacts from the use of MTAs are analyzed in Sections 4.5.4 and 4.5.5.

For purposes of this analysis, the estimated number of potential future research projects that would not be undertaken under Alternative C was estimated based on 1992–2001 park research activity. The NPS is not aware of data or other information that is inconsistent with these findings and projections. The loss of scientific knowledge that could have been obtained from research projects that may be abandoned or never begun under Alternative C cannot be predicted in detail. Long-term impacts are analyzed over the 20-year period following implementation of the alternative. This DEIS considers any change that is evident for five years or less to be short-term.

4.5.1 Analysis Common to All Impact Topics

In order to illustrate the potential impacts of Alternative C, information from 2001 was analyzed.

The number of research permit applications that would have been denied if Alternative C had been in effect in 2001 is presented in Table 4.5.1, below. These 12 research projects could have been conducted without park specimens. However, the level of difficulty in obtaining non-NPS specimens would have varied, as would each project’s specific research results, because NPS units contain relatively intact natural systems and offer research opportunities that may not be available outside the NPS. Table 4.5.1 shows the percentage of 2001 research permit applications that would have been denied for each context under analysis (servicewide, Yellowstone National Park, and other individual parks). In addition, some unknown number of researchers would likely have avoided the potential adverse impacts of Alternative C entirely by not beginning future research involving specimens collected from NPS units.

Table 4.5.1. Potential consequences of Alternative C

	Servicewide	Yellowstone	Individual parks
Number of 2001 research permit applications that would have been denied	12	7	5 applications involving 7 parks
% of 2001 research projects	0.6%	3%	1% to 20%

Table 4.5.1. Under Alternative C, research specimen collection for research involving any potential commercial applications would be prohibited. In order to illustrate the potential impacts of Alternative C, information from 2001 was analyzed.

4.5.2 Natural Resource Management

Alternative C could result in impacts from the loss of current and future research projects in the NPS. In addition, although the ratio of bioprospectors to all researchers who study park resources is very small, Alternative C could cause some loss of potential research discoveries and scientific data that could have improved understanding of the natural resources that the NPS protects and manages.⁴⁷ This impact has both quantitative (number of researchers, research projects, and resulting data) and qualitative (sophistication of the science, relevance to NPS natural resource management, and quality of data) dimensions.

The specific data and discoveries useful for natural resource management that might be lost cannot be known. However, particular losses could be expected in microbiology, which is the specialized field of biological research that has resulted in every known patent resulting from study of biological material originating in the NPS. Because it is becoming increasingly clear that ecosystem processes are largely mediated by microorganisms, and because NPS resource managers generally lack expertise in microbiology, this loss of potential knowledge could be substantial in the future.⁴⁸

Information developed by microbiologists, whether or not they are bioprospectors, can add substantially to natural resource managers' knowledge base. In 2001, at least 72 IARs were submitted to the NPS by microbiologists. During that year, the NPS identified 6 of those 72 projects (8% of microbiologists and less than 1% of all researchers) as declared bioprospecting. Under Alternative C, that small proportion of microbiologists would have been denied permission to collect research specimens. It is reasonably foreseeable that a few additional microbiologists would consider themselves to be undeclared bioprospectors and would therefore avoid applying for an NPS research permit.

4.5.2.1 Servicewide impacts

Based on past data, such as the potential loss of less than 1% of research projects servicewide (see Table 4.5.1), the qualitative impacts to servicewide natural resource management from the loss of potential future research projects would likely be long-term, adverse, and would appear to be negligible servicewide, because there would likely be slight change in the availability of new scientific knowledge about park resources servicewide. Quantitatively, there would appear to be long-term, adverse impacts to natural resource management of a negligible intensity servicewide, in light of the relatively small number of research projects affected and the quality of scientific information otherwise available to the NPS as a whole. For example, a potential loss of 8% of permitted microbiologists as described above would appear to have a negligible adverse impact on the quality of knowledge about NPS microbial resources servicewide.

4.5.2.2 Yellowstone-specific impacts

Based on past data, the number of potential future research projects that would be lost under Alternative C would likely be small. However, the impacts resulting from the loss of a single high-quality scientific study revealing important new information about Yellowstone's natural resources could be meaningful.

For example, because Yellowstone has recognized that inventories of thermal life are important, it has authorized several research projects to conduct such inventories, including one conducted by a declared bioprospector.⁴⁹ The loss of microbial inventory data caused by a reduced number of inventories could have a moderate impact on Yellowstone's understanding and management of its hot spring environments. Although natural resource managers recognize the importance of such biological inventories, appropriate park funding for such inventories is limited.

Under Alternative C, the CRADA between Yellowstone National Park and Diversa Corporation, currently suspended, would be nullified, and all monetary benefits provided to Yellowstone by Diversa pursuant to the CRADA before its suspension would be returned to

Diversa. In addition, Diversa also would not make any performance-based payments to the park from development of Pyrolase 200™ or from any other product Diversa has developed from its research activities at Yellowstone (*see* Section 4.4.2.4 and Chapter 1, Section 1.8.1.1). Loss of the CRADA's previously arranged up-front payment of \$100,000, equivalent to 1.14% of the FY2002 operational funding for natural resource management that was identified in Yellowstone's Business Plan (*see* Chapter 3, Section 3.2.2), represents a short-term, adverse, negligible impact on Yellowstone's natural resource management.

The number of research projects that would be eliminated under Alternative C is expected to be small. However, if a substantial proportion of researchers studying topics related to Yellowstone's natural resource management priorities abandoned or did not begin park-related research under Alternative C, it would constitute a long-term, major, adverse impact to Yellowstone natural resource management. For these reasons, although past data indicate that the potential loss of at least 3% of independent research projects in Yellowstone would appear to result in long-term, adverse, negligible quantitative impacts, the qualitative impacts to natural resource management at Yellowstone resulting from such a loss could be long-term, adverse, and negligible-to-major.

4.5.2.3 Individual park impacts

Because there could be a reduction in the number of research projects conducted in some parks, the potential for loss of valuable scientific information that could impact natural resource management is greatest in parks where a large proportion of research projects would either be denied authorization or would never be proposed because researchers avoided park research under Alternative C.

If Alternative C had been in effect in 2001, between 1% and at least 20% of independent research projects potentially would have been lost in the eight individual parks where declared bioprospectors held NPS research permits (*see* Chapter 3, Section 3.4.3). Such losses would represent quantitatively long-term, adverse, and negligible-to-moderate impacts to natural resource management.

The impact of the loss of a single research project in a typical park with few independent research projects is illustrated by examining NPS research in 62 parks that received six or fewer research reports from independent scientists in 2001. The loss of a single research project in any of those parks would have represented a 17–100% decrease in independent research activity, resulting in quantitatively long-term, adverse, moderate-to-major impacts on natural resource management.

Qualitative impacts in both cases could be more adverse than quantitative impacts, depending upon the specific park projects or goals that could be affected.

In sum, quantitative and qualitative impacts to natural resource management for individual parks could be expected to be long-term, adverse, and negligible-to-major.

4.5.2.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.5.2.5 Conclusion

There would likely be a reduction in the number of research projects authorized under Alternative C compared to Alternatives A and B. Accordingly, there could be a reduction in the scientific information that would be generated from such projects that could impact NPS natural resource management. The impacts of Alternative C on NPS natural resource management are thus likely to be long-term and adverse in all three contexts. Qualitatively, these long-term, adverse impacts appear to be negligible servicewide, negligible-to-major in Yellowstone, and negligible-to-major at the individual park level. Because the relative number of such projects that would be affected servicewide is very low (perhaps as low as 0.5%), and because the NPS has access to a great deal of scientific information from many sources, quantitatively, these long-term, adverse impacts appear to be negligible servicewide, negligible in Yellowstone, and negligible-to-major at the individual park level.

4.5.2.6 Cumulative impacts

The cumulative scenario was described in Section 4.3.2.6.

The many variables that can affect future research trends prohibit a meaningful assessment of the number, quality and location of future research projects or reliable determination of whether the current trends in research will continue. Only as new permit applications are submitted to the NPS will it become possible to identify with greater certainty any measurable level of adverse impacts to natural resource management resulting from Alternative C.

The cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on NPS natural resource management in all contexts by providing additional scientific knowledge for park natural resource management decision-making. However, these beneficial impacts could be offset under Alternative C since some researchers would be denied permission to collect NPS research specimens. Bioprospectors often use the newest and most advanced scientific techniques, and discouraging bioprospectors from studying park resources by denying them permission to collect park specimens would decrease the rate at which new science becomes available to parks.

At the Servicewide level, Alternative C is likely to result in only a slight change in the availability of new scientific knowledge about park resources. As a result, this alternative would not demonstrably alter the cumulative impact to actions outlined in the cumulative scenario for natural resources at the servicewide level.

These impacts to natural resource management could be less favorable to certain parks or specific natural resource management projects. The potential reduction in research projects under Alternative C cannot be defined quantitatively, however for specific parks, the loss of certain scientific knowledge could impact a park's natural resource management program.

Most parks have not identified any declared bioprospectors and therefore are less likely to experience a reduction in research under Alternative C. For these parks, no cumulative impacts would result from this alternative.

Yellowstone National Park and other parks that could deny some researchers permission to collect specimens under Alternative C may experience negligible-to-major adverse impacts to the management of park natural resources. In some cases, these adverse impacts could offset the beneficial impacts described in the cumulative scenario. In other cases, the actions described in the cumulative scenario could be expected to replace some of the specialized scientific knowledge no longer available from bioprospectors under Alternative C. When Alternative C's adverse impacts are combined with the beneficial impacts of actions outlined in the cumulative scenario, the cumulative adverse impacts that result could range from negligible (if there is only a slight overall loss of scientific information) to minor (if scientific information relating to a natural resource management priority could not be practically acquired otherwise).

4.5.3 Visitor Experience and Enjoyment

Alternative C could result in impacts to visitor experience and enjoyment resulting from a potential reduction in the amount of available scientific research results and the number of collaborative interactions with researchers that the NPS uses to develop interpretive services for visitors.

4.5.3.1 Servicewide impacts

The servicewide impacts to visitor experience and enjoyment from loss of potential future research projects can only be examined in general terms, because the specific data and discoveries that would have been useful for interpretation targeted towards natural resource management goals cannot be known in advance of potential future research projects. However, because the estimated number of research permit applications that would be denied is so small (*see* Table 4.5.1), the servicewide impacts appear to be long-term, adverse, and negligible.

4.5.3.2 Yellowstone-specific impacts

Similarly to servicewide impacts, the impacts to Yellowstone visitor experience and enjoyment from the loss of potential future research projects can only be examined in general terms. In particular, the specific data and discoveries that would have been useful for interpretation targeted toward resource protection cannot be known in advance of potential future research projects. However, one of the co-investigators in a 2001 research project that would not have occurred if Alternative C had been in effect was also a member of the scientific review panel for the new Old Faithful Visitor Education Center. It is reasonable to expect that this researcher would not have been conducting research in the park, and therefore would not have been in a position to participate on this scientific review panel, if Alternative C had been in effect.

Accordingly, although the potential loss of at least 3% of independent research projects in Yellowstone appears to be quantitatively long-term, adverse, and negligible for visitor experience and enjoyment overall, for specific projects the loss could be qualitatively long-term, adverse, and negligible-to-minor.

4.5.3.3 Individual park impacts

Again, the impacts to park-specific visitor experience and enjoyment from loss of potential

future research projects can only be examined in general terms (*see also* Section 4.5.2.3). In all cases, impacts would be long-term and adverse. Qualitative impacts in any park could range from negligible-to-major relative to specific goals related to visitor experience and enjoyment. For certain parks, the resultant loss of information for interpretation of science from a key research project would be substantial. Impacts in parks with few independent researchers would be quantitatively more adverse than in parks with many independent researchers, ranging from negligible-to-major.

4.5.3.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.5.3.5 Conclusion

Under Alternative C, there would be long-term, adverse effects related to a small reduction in the number of researchers at work in parks in all three contexts. Qualitatively, these long-term, adverse impacts could be negligible servicewide, negligible-to-minor in Yellowstone, and negligible-to-major at the individual park level. Quantitatively, these long-term, adverse impacts appear to be negligible servicewide, negligible in Yellowstone, and negligible-to-major in other specific parks.

4.5.3.6 Cumulative impacts

The cumulative impacts of the NPS programs and initiatives described in the cumulative scenario are expected to have a beneficial long-term impact on visitor experience and enjoyment in all contexts by improving NPS interpretive services. The negligible adverse impacts to visitor experience and enjoyment that result from Alternative C's small reduction in the number of researchers at work in parks would not demonstrably alter the cumulative beneficial impact to servicewide or Yellowstone visitor experience and enjoyment. The negligible-to-major adverse impacts to visitor experience and enjoyment that could result from the loss of partnership opportunities with researchers under Alternative C in some other individual parks could effectively reduce the beneficial cumulative impact of actions described in the cumulative scenario in a few individual parks.

4.5.4 Social Resources: The Research Community

Under Alternative C, certain researchers would be prohibited from collecting research specimens in national park units, and all researchers would be prohibited from commercial development of their research results, barring a select few, case-by-case exceptions as determined by the NPS director (*see* Chapter 2, Section 2.5.1).⁵⁰

4.5.4.1 Impacts to declared bioprospectors

Under Alternative C, researchers who identified or acknowledged that their research results could have some commercial application (declared bioprospectors) and were qualified in all other respects could be issued a research permit, but would not be authorized to collect research specimens.

If Alternative C had been in effect in 2001, approximately 23 researchers in 8 parks of the 4,568 total permitted researchers (0.5% of researchers), accounting for 12 of the 2,160 total research projects (0.6% of projects) that were registered in the RPRS could have been denied

permission to collect NPS research specimens. These 23 researchers could have continued to conduct research without park specimens, thus avoiding a major adverse impact. However, the level of difficulty in obtaining non-NPS specimens would vary. Some of these 23 researchers could find more or less similar specimens outside of parks. Others would have more difficulty; for example, researchers who study thermophilic microorganisms might collect specimens in degraded thermal areas outside the protection of parks at some loss of specimen quality. Other thermophilic microorganism specimens could be collected in extremely remote areas (e.g., in the deep ocean), but at a significant expense. In all cases, an NPS specimen might have had more desirable attributes for study than its non-NPS substitute and the researcher might have discovered a commercially applicable research result studying a park specimen that would not have been discovered otherwise. Accordingly, declared bioprospectors (approximately 0.5% of the research community) would experience long-term, adverse, minor-to-moderate impacts under Alternative C.

Alternative C responds to public advice to prohibit commercialization of NPS-related research by denying permission to collect research specimens if there is any connection between proposed specimen collection and an identified or acknowledged commercial use of research results. Accordingly, some researchers who are not usually considered to be bioprospectors could also be affected by Alternative C. For example, a research project that the researcher acknowledged would result in the development of commercially valuable software to interpret scientific data would be prohibited from studying NPS research specimens. The number of such researchers who would be affected in this way by Alternative C, although likely very small, cannot be determined from available data. Accordingly, potential adverse impacts to the research community may involve more than the 0.5% of the research community identified in the paragraph above.

4.5.4.2 Impacts to inadvertent and undeclared bioprospectors

Impacts to undeclared and inadvertent bioprospectors would be only slightly discernible in the NPS research community as a whole, because less than 1% of NPS-permitted researchers perform such research (*see* Section 3.4.3).

Some undeclared bioprospectors could prefer to keep their options open for commercialization by refraining from proposing or conducting research involving research material originally collected in an NPS unit. As described for declared bioprospectors, the level of difficulty in obtaining non-NPS specimens would vary, as would each researcher's specific research results, because NPS units contain relatively intact natural systems and offer research opportunities that may not be available outside the NPS.

Under Alternative C, inadvertent bioprospectors would be prohibited from developing any discoveries resulting from research involving NPS research specimens that could have some valuable commercial application unless such development was determined in writing by the NPS director to be in the public interest. Inadvertent bioprospectors whose discoveries were not determined to be in the public interest and therefore were not permitted to use their research results for commercial purposes could be prevented from having the opportunity to realize economic gains from their research results. In addition, because some research projects require long-term, historical, site-specific data, a researcher involved in such a project might not welcome the inadvertent realization that his research results could have

commercial applicability. Such inadvertent bioprospectors who considered themselves basic researchers with no intention for their studies to have commercial application would experience a major adverse impact if they had to discontinue long-term study of NPS specimens when they recognized and acknowledged a foreseeable commercial use for their research results.

Accordingly under Alternative C, inadvertent bioprospectors and some undeclared bioprospectors, a small minority of the research community, could experience long-term, adverse, negligible-to-major impacts.

4.5.4.3 Impacts to researchers who transfer specimens to others, researchers who receive transfers, and all other researchers

Currently, there is no standardized process or format for requesting NPS authorization of third-party transfers of research specimens that will be consumed during analysis and are therefore not suitable for permanent retention as museum specimens. Standardization of MTAs is expected to reduce the workload associated with making such requests by streamlining the process and eliminating additional paperwork associated with multiple versions of MTAs issued by individual parks, thus providing a beneficial impact to researchers. The workload for researchers would be substantially less than the 1.6 hours required to obtain an NPS research permit.

In addition, use of the standardized MTA would clearly subject third-party transfer recipients to Alternative C's prohibition of commercialization of research results and likely would induce undeclared bioprospectors to consider foregoing conducting their research using NPS specimens. Accordingly, Alternative C's impacts to bioprospectors, as described previously, could apply to more researchers than those who personally collect research material from NPS units under NPS research permits. Overall, the impacts to these researchers are considered to be long-term, beneficial, and negligible.

4.5.4.4 Mitigation measures

Under Alternative C, the burden of identifying and declaring potential commercial applications for research results would be placed on the researcher rather than the park. This would serve to protect researchers from being unfairly denied permission to collect specimens. Therefore, researchers who have no plans or expectations of making commercial use of their research results and who meet all of the other qualifications for an NPS research permit could be granted permission to collect specimens regardless of whether or not they study specific topics with recognized commercial potential.

4.5.4.5 Conclusion

Adverse impacts would occur to somewhat more than 0.5% of the research community.

All researchers would be prohibited from using their research results for commercial purposes and would thereby be prevented from seeking economic gain from them (unless such use was determined in writing by the NPS director to be in the public interest, in the case of inadvertent bioprospectors). Declared bioprospectors also would be denied permission to collect research specimens from national park units. As such, they could experience short-to-long-term, adverse, minor-to-moderate impacts.

Inadvertent bioprospectors would experience long-term impacts under Alternative C that could be adverse, minor-to-major impacts in the event that they were prevented from performing research based on past studies or from realizing economic gain from research results.

Some undeclared bioprospectors could be expected to discontinue conducting or planning studies under NPS research permits, which would have long-term, adverse, negligible-to-major impacts on those researchers.

Researchers who transfer or receive transferred specimens, and all other researchers, would experience long-term, beneficial, negligible impacts from the institution of standardized MTAs. They would also be subject to Alternative C's prohibition of commercialization of research results and the impacts described for bioprospectors.

4.5.4.6 Cumulative impacts

Under Alternative C, some researchers would be excluded from studying material originating as a park specimen and others would choose not to study such material (estimated to be somewhat more than 0.5% of the research community described in this DEIS). For this minority of the research community, Alternative C's adverse impacts combined with the impacts described in the cumulative scenario could result in either a less beneficial or a more adverse cumulative impact than the impact of the cumulative scenario alone. For researchers who participate in material transfers, the negligible beneficial impact of Alternative C would not demonstrably alter the cumulative impact of other actions outlined in the cumulative scenario. The actions of Alternative C would have no impact to all other researchers, therefore there would be no demonstrable addition to the total cumulative impact these researchers experience from other sources.

4.5.5 Social Resources: NPS Administrative Operations

Under Alternative C, there would be no benefits-sharing agreements to administer. Some researchers would not conduct studies in NPS units, and NPS authorization of third-party transfers of research specimens not suitable for permanent retention as museum collections would occur through standardized MTAs.

4.5.5.1 Servicewide impacts

Somewhat more than 0.5% of researchers would be expected to drop plans for conducting studies under NPS research permits. Such a reduction in the number of researchers working in parks would represent a long-term, beneficial, negligible impact on the administrative burden associated with managing research permits.

Based on Yellowstone National Park data, the time required to execute an MTA is 1 hour and 30 minutes.⁵¹ Information relevant to evaluating the number of MTAs that would be executed servicewide is unavailable, because no systematic way has been established to conduct, manage, or report on these authorizations. The impact of adding standardization to the current requirement to authorize third-party transfers of NPS research specimens or other material originating as an NPS research specimen, particularly for material that is unsuitable for permanent retention as a museum collection, is expected to be long-term, beneficial, and negligible.

4.5.5.2 Yellowstone-specific impacts

Somewhat more than 3% of researchers in Yellowstone would be expected to abandon or not begin park-related studies. Processing a research permit application requires approximately 0.03 FTE (*see* Chapter 3, Section 3.5.2). If the seven declared bioprospectors identified for Yellowstone in 2001 stopped conducting research in the park, 0.21 fewer FTE (0.2% of the available FTE identified in Yellowstone's Business Plan) would be necessary to process research permit applications. Such a reduction in the number of researchers working in Yellowstone would represent a long-term, beneficial, negligible impact on the administrative burden associated with managing research permits.

Because Yellowstone National Park has used standardized MTAs since 2000, their servicewide introduction would have no impact in this context.

4.5.5.3 Individual park impacts

A reduction in the number of researchers working in parks would represent a long-term, beneficial impact on the administrative burden associated with managing research permits in individual parks. Because only a single declared bioprospector was identified in 2001 in any individual park (other than Yellowstone), it is anticipated that 0.03 fewer FTE would be required for any park that would avoid processing a single research permit application (*see* Chapter 3, Section 3.5.2).

Other than Yellowstone, 31 of the 44 park business plans previously described include information about existing administrative resources.⁵² The number of available administrative FTE per park varies considerably (*see* Table 4.4.5.3). If individual parks avoided processing a single research permit application, the FTE no longer required for that purpose would represent, at most, 0.6% of available FTE. For this reason, the potential impacts to NPS administrative operations of Alternative C's reduction in the number of researchers applying for research permits at the individual park level would be long-term, beneficial, and negligible in all reasonably foreseeable cases.

The impact of adding standardized MTAs to the current processes to authorize third-party transfers of NPS research specimens or other material originating as an NPS research specimen is expected to be long-term, beneficial, and negligible.

4.5.5.4 Mitigation measures

The NPS has not identified any mitigation measures.

4.5.5.5 Conclusion

The impacts of Alternative C on NPS administrative operations in all contexts (servicewide, Yellowstone National Park and other individual parks) would be long-term, beneficial and negligible.

4.5.5.6 Cumulative impacts

Under Alternative C, potential reductions in the number of research proposals and implementation of standardized MTAs would have a negligible beneficial impact on administrative operations in all contexts. These negligible beneficial impacts would not demonstrably alter the cumulative impact of other actions outlined in the cumulative scenario for all contexts.

4.5.6 Irreversible and Irretrievable Commitments of Resources

Alternative C would not result in the temporary or permanent loss of any resources.

4.5.7 Relationship Between Short-Term Uses of the Environment and Maintenance and Enhancement of Long-Term Productivity

Alternative C would slightly restrict specimen collection activities from NPS units. Long-term productivity of the environment would be unaffected by Alternative C.

4.5.8 Adverse Effects that Cannot Be Avoided

The DEIS reveals the possible environmental impacts of choosing whether or not to implement a certain type of contract. Hence, the nature of this DEIS is such that its affected environment and impact topics relate primarily to administrative functions of the NPS. The actions of this alternative that will result in adverse impacts that cannot be fully mitigated or avoided are related to these administrative functions. Alternative C would prohibit some researchers from studying NPS research specimens, some of whom would not find appropriate specimen collection sites outside the NPS. Other adverse impacts of the alternative would be mitigated by the beneficial actions described in the cumulative scenarios.

Notes

Section 4.1 Introduction

¹ National Park Service Organic Act, 16 USC 1.

² The Federal Technology Transfer Act of 1986 (FTTA) requires that benefits generated for parks be used for research consistent with a park's mission. The FTTA also allows the use of benefits for scientific education and training or scientific exchange among the parks as well as for administration of the CRADA (15 USC Section 3710a; *see also* Chapter 4, Section 4.4.1).

Section 4.2 Methodologies for Evaluating Impacts

³ *See, e.g.,* C. J. Widner, "Reducing Theft of Petrified Wood at Petrified Forest National Park," *Journal of Interpretation Research* 5(1):1–18.

⁴ Any specific discoveries that could be used for commercial purposes cannot be known in advance of the actual discovery. In addition, proprietary information about any current commercial use of research results also is unavailable. In the absence of the supplemental reporting requirements that would be in effect pursuant to a CRADA, the NPS does not have access to proprietary information concerning any income resulting from any researcher's commercial uses of research results.

⁵ National Park Service, *National Park Service Management Policies 2001* (Washington, D.C.: U.S. Department of the Interior, 2000).

⁶ *See* 40 CFR 1508.7.

Section 4.3 Alternative A: No Benefits-Sharing/No Action

⁷ Diversa scientists have continued to study Yellowstone resources. In 2004, they applied for and obtained a research permit to explore the microbial diversity in Yellowstone Lake. Their preliminary results almost doubled the known number of microbe species in the lake and provided a proof-of-concept for a new biodiversity assessment model melding classic Linnaean taxonomy with genomic inventories (Eric Mathur, "Biomolecular Diversity in Yellowstone National Park," NPS Investigator's Annual Report, 2004), available online at <<http://rprs.nps.gov/research/ac/iars/search/iarView?reportId=32666>>, last accessed April 18, 2006.

⁸ National Park Service, *Funding the Natural Resource Challenge: A Report to Congress, FY 2001, 12*, available

online at <<http://www.nature.nps.gov/challenge/congress/congressreport2001.pdf>>, last accessed March 20, 2006.

⁹ For additional information and materials, see <<http://www.cesu.org/cesu>>.

¹⁰ National Science Foundation, Division of Science Resources Statistics, National Patterns of Research and Development Resources: 2003, NSF 05-308, Brandon Shackelford (Arlington, VA 2005). see also Rapoport, A. I. 1999. How has the field mix of federal research funding changed over the past three decades? National Science Foundation/Division of Science Resources Studies Issue Brief.

¹¹ Personal experience of the IDT gained from reviewing hundreds of park research proposals. Data regarding funding sources for NPS permitted research projects service-wide has not been compiled. (see also Section 4.3.3.6)

¹² Analysis of the intensity of potential beneficial economic impacts was limited to potential income related to licensing of research results. Proprietary business information about other forms of income related to the commercial use of research results, such as income related to patent right sales or from actual product sales, was unavailable for analysis. The record of licensing income to universities and federal laboratories indicates that income to a researcher's institution from licensing of research results generates between \$0 and more than \$1 million per license. (More detailed analysis of such license income is presented in this chapter, Section 4.4.1.3 and in Appendix C.)

¹³ AUTM 2003 reports that 66% of research expenditures that year were funded from federal sources.

¹⁴ NPS Natural Resource Year in Review --- 2004. see also National Research Council. 1992. Science and the National Parks. National Academy Press, Washington, D.C. "The parks are invaluable for unraveling the mysteries of natural and human history, evolutionary adaptation, ecosystem dynamics, and other natural processes."

Section 4.4 Alternative B: Implement Benefits-Sharing

¹⁵ The FTTA authorizes private-sector research partners to provide funds through CRADAs to be used to support the participating federal laboratory's research activities consistent with its mission. This DEIS terms such payments "up-front payments." Not all benefits-sharing agreements would generate up-front payments. The FTTA also authorizes private-sector research partners to provide performance-based payments that would likely be due to the NPS whenever (and if) the researcher's institution derived any kind of income from research results. Income can be generated in a number of ways in addition to product sales. For example, income can be produced by the performance of contract research, such as screening compound libraries. Income can also be produced if intermediate research results are licensed to another institution. Licenses can generate income for the researcher's institution through license issue fees, annual minimum payments, milestone payments (payments based on successful completion of certain R&D stages, described in Chapter 3, Section 3.4.3), or royalties.

¹⁶ See 15 USC 3710c.

¹⁷ See 15 USC 3710a(d)(1) and 3710c.

¹⁸ The fundamental purpose of the National Park System is established by the NPS Organic Act, and reaffirmed by the General Authorities Act, as amended and interpreted for the NPS by NPS Director's Order #55.

¹⁹ A chi-square test was performed to determine if the null hypothesis ("There was no change in the number of reports/permits before 1997 and after 1997") could be rejected. In each case, there was no evidence of a significant difference in the number of reports submitted (or, in one dataset, permits issued) before and after NPS announced the benefits-sharing agreement between Yellowstone and Diversa. In other words, the null hypothesis could not be rejected (see also Appendix E).

²⁰ See, e.g., A. Artuso, *Drugs of Natural Origin: Economic and Policy Aspects of Discovery, Development, and Marketing* (Binghamton, New York: The Haworth Press, 1997); W. H. Lesser and A. F. Krattiger, "The Complexities of Negotiating Terms for Germplasm Collection," *Diversity* 10(3).

²¹ *Public Citizen Health Research Group v. National Institutes of Health, et al.*, Civil Action No. 00-1847 (DDC 2002) (Memorandum Opinion dated March 11, 2002). See also 5 USC 552 (b)(4).

²² Ibid.

²³ For example, Exemption 4 requires federal agencies to withhold "trade secrets and commercial or financial information obtained from a person and privileged or confidential" when responding to FOIA requests (see 5 USC 552 (b)(4)).

²⁴ Although potential monetary benefits were compared to Natural Resource Challenge funding, such benefits might not be useable by the same programs funded by the Challenge.

²⁵ Yellowstone National Park, *Resource Management Plan* (1995).

²⁶ See, e.g., Widner, "Reducing Theft of Petrified Wood at Petrified Forest National Park."

²⁷ For example, Article 4.1 of the standardized CRADA proposed by Alternative B authorizes the park superintendent to require research reports containing whatever level of detail the superintendent requests (see Appendix A).

- ²⁸ See Appendix A, Article 7.1, requiring the benefits-sharing partners to disclose all inventions.
- ²⁹ Similar assistance has recently been given by researchers to Yellowstone National Park.
- ³⁰ About 90 researchers were identified by the NPS between about 1990 and 2002 as possible declared or undeclared bioprospectors. About 80 of these scientists actually held NPS research permits; the remainder made inquiries only. During a similar time frame (1992–2001), the NPS received more than 20,500 research reports from permitted researchers.
- ³¹ See *Public Citizen Health Research Group v. National Institutes of Health*, Civil Action No. 00-1847 (DDC Memorandum Opinion dated March 12, 2002 (Colleen Kollar-Kotelly, J.)).
- ³² Such negotiations would meet the requirement for benefits-sharing agreements to be equitable as mandated by the National Parks Omnibus Management Act (16 USC Chapter 79, Section 5935(d)).
- ³³ 15 USC 3710c.
- ³⁴ In addition to those activities listed in the text, other work associated with the AUTM-reported FTE include technology valuation and license agreement drafting and negotiation.
- ³⁵ C. Hendrix, Yellowstone Research Permit Coordinator, pers. comm. to A. Deutch, November 2003.
- ³⁶ Most Business Plans that were prepared in 1999 (the first year of the Business Plan Initiative) did not include FTE information.
- ³⁷ See 5 USC 552 (b)(4).
- ³⁸ Such assistance would be consistent with the guidelines relating to development of CRADAs first published by the Department of the Interior in May 1996.
- ³⁹ 15 USC 3710c(a)(1)(B)(iv).
- ⁴⁰ The proposed MTA and related procedures described in Alternative B are based on the Uniform Biological Material Transfer Agreement developed by the National Institutes of Health in 1995, in part to minimize administrative burden. Accordingly, any adverse impacts on NPS administrative operations also would be minimized.
- ⁴¹ C. Hendrix, Yellowstone Research Coordinator, pers. comm. to A. Deutch, November 2003.
- ⁴² See OMB Circular A-123, Management Accountability and Control (1995).
- ⁴³ Ibid.
- ⁴⁴ The potential mitigation impacts of this distinction on specimen collection activities in NPS units have been recognized and affirmed on judicial review. See *Edmonds Institute, et al. v. Babbitt, et al.*, 93 F. Supp. 2d 63, at 70 (DDC 2000) (“[W]hile in certain respects the CRADA may impose restrictions on [the research firm’s] research activities over and above those provided by a permit alone, the research permit, not the CRADA, provides the legal basis for [the research firm] to collect specimens. For example, the CRADA may give Park officials *greater* control of specimen extraction. . . .” (emphasis added)).
- ⁴⁵ See OMB Circular A-123.

Section 4.5 Alternative C: Prohibit Research Specimen Collection for Any Commercially Related Research Purposes

- ⁴⁶ Material Transfer Agreements (MTAs) are not “benefits-sharing” agreements, because they do not contain revenue-sharing or other benefits-sharing terms or obligations.
- ⁴⁷ About 90 researchers were identified by the NPS between about 1990 and 2002 as possible declared or undeclared bioprospectors. About 80 of these scientists actually held NPS research permits and the remainder made inquiries only. During a similar time frame (1992–2001) the NPS received more than 20,500 research reports from permitted researchers.
- ⁴⁸ For example, on the Colorado Plateau, the ecosystem role of biological soil crusts, composed entirely of microorganisms and non-vascular plants, has been recognized to be so important that federal land managers on the plateau usually consider potential impacts to crusts in their environmental assessments of proposed Colorado Plateau projects (*High Country News*, “Biologist Jayne Belnap,” January 19, 2004; see also R. Constanza et al., “The Value of the World’s Ecosystem Services and Natural Capital,” *Nature* 387:253–260).
- ⁴⁹ In 2001, Yellowstone permitted a microbiologist to begin a study of thermophilic viruses with two objectives: (1) to discover new information about these seldom-studied viruses, and (2) to discover “various applications” for the new discoveries. This study, partly motivated by bioprospecting, evolved into a thorough inventory of all the microscopic life forms in a single hot spring (T. Schoenfeld, “Viral Populations in Thermal Environments,” NPS Investigators’ Annual Report, 2001, available online at <<http://science.nature.nps.gov/research/ac/iars/search/iarView?reportId=20842>>; T. Schoenfeld, “Microbial Life in Thermal Environments,” NPS Investigators’ Annual Report, 2002, available online at <<http://science.nature.nps.gov/research/ac/iars/search/iarView?reportId=23913>>; T. Schoenfeld, “Microbial Life in Thermal Environments,” NPS Investigators’ Annual Report, 2003, available online at <<http://science.nature.nps.gov/research/ac/iars/search/iarView?reportId=27141>>, all last accessed April 18, 2006).
- ⁵⁰ The NPS director could authorize commercial development of an inadvertent or otherwise unexpected

valuable discovery based on a finding by the director that refusal to authorize such development could be harmful to public health or other overriding public interest (such as discovery and development of an important new medicine).

⁵¹ C. Hendrix, Yellowstone Research Permit Coordinator, pers. comm. to A. Deutch, November 2003.

⁵² Most Business Plans that were prepared in 1999 (the first year of the Business Plan Initiative) did not include FTE information.